MODEL AIRPLANE NEWS

JUNE 1944 • 20 CENTS

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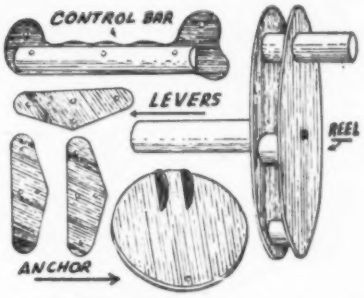

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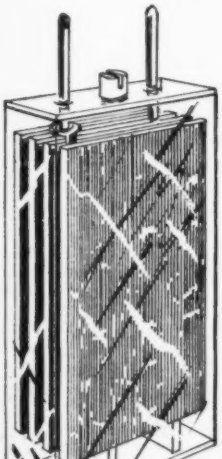

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MODEL AIRPLANE NEWS

JUNE, 1944 Vol. XXX, No. 6

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AN AIR AGE PUBLICATION

Published monthly by Air Age, Inc., Mount Morris, Illinois. Editorial and advertising offices: 551 Fifth Ave., New York 17, N. Y. George C. Johnson, President. Entered as second class matter Dec. 6, 1934 at the post office at Mount Morris, Ill., under the act of March 3, 1879. Additional entry at New York, N. Y. Price 20c per copy. Subscriptions $2 per year in the United States and possessions; also Canada, Cuba, Mexico, Panama and South America. All other countries $2.50 per year.
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FLASH

THIS MONTH HAS SEEN a shift in offensive emphasis from the War in Europe to the War in the Pacific, insofar as the news is concerned. With the attack on Palau, just 550 miles east of the Philippines, by Admiral Halsey's mammoth Pacific Fleet, the largest naval power ever assembled, the first stage in the Pacific offensive may be considered accomplished.

MacArthur's plan since he left Bataan just two years ago has been the recapture of the Philippines, but this is obviously impossible until the Japanese have been cleared from their positions scattered throughout the Pacific. Halsey's magnificently successful campaigns against the Gilberts, the Marshalls, the Carolines (including much-vaunted Truk) and now his neutralizing of Palau, would appear to have achieved the first objective and set the stage for the second act. Halsey, in so doing, has thrown the plans badly out of schedule for, certainly, no major land campaign in the Philippines can be undertaken for some time. The veteran naval commander has done his job much better and much sooner than was asked of him.

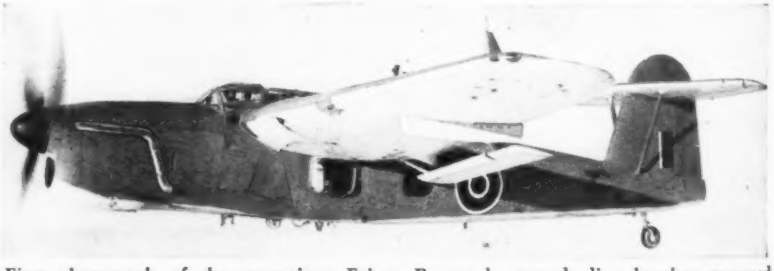
Some observers suggest that perhaps the Philippines might be by-passed in favor of a sea-air offensive against the Japanese mainland itself. Attacks in the Kuriles indicate an aerial pincers movement and, should this be combined with stepped-up aerial attacks from carrier borne aircraft east and south of Japan, a possible early bombardment offensive on Tokyo.

Such speculation may appear unduly optimistic but the action (or inaction) of the Japanese Fleet warrants such encouragement. Japanese aerial and naval strength was long believed to be centered in three principal strongholds of enormous strength. The neutralization of Rabaul, first in line, came according to schedule with little Japanese Fleet action. Then came the surprise: the successful attack on Truk, believed impregnable. Again the Japanese Fleet fled the scene prior to the attack. Hard on the trail, Halsey's ships and planes continued westward and found Palau and Yap empty of the main Japanese floating power. The U.S. Navy is now in virtual control of all the Japanese mandated islands in the Pacific, areas which have not been seen by a white man since 1919!

Make no mistake the Japanese Fleet is still powerful although it is believed to be rather badly balanced. Battleships and heavy cruisers are still intact, and this is a potent force. But the shortage of cruisers, destroyers and secondary carriers, which have been bombed and sunk in large numbers, indicate the primary reason for the reticence of the Japanese main fleet to accept battle. Heavy units must be adequately protected in battle and a flock of destroyers and light cruisers can make quick meat of one or more battle-

(Turn to page 30)

Latest version of the deadly Douglas *Havoc* features the installation of a power driven turret containing two .50-caliber guns. *Havoc* is fastest, deadliest of its type in the world.



First photograph of the mysterious Fairey *Barracuda* torpedo-dive bomber powered by Rolls-Royce *Merlin* engine. Dive brakes are clearly shown in this view. (See page 36)

Yea, Fellers! I'M UP IN THE AIR ABOUT THESE SWELL FLYING MODELS

YOU'LL BE, TOO, WHEN YOU BUILD 'EM AND FLY 'EM!

Modelcraft "SPOOK"

pioneered this sensational gull-wing design in models. Some of you fellows were skeptical. Then you saw Spooks in action, and finally the Navy came along and adopted gull-wings for some of their best bombers. Then everybody got convinced. (Gulls are recognized for their unsurpassed soaring ability and have long been used as a basis of aircraft design.)

SENSATIONAL GULL-WING "48"

Spook 48 is truly *a class A model with class B performance!* The gull-wing design adds stability for any type of weather conditions plus an *extremely low sinking speed.* Best of all, construction is simple (no miles of formers to make), and as easy as a dihedral and easier than a polyhedral. Will perform with any good A or B engine.

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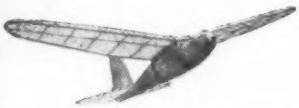

SOARING GLIDER

And we mean *soaring!* Why this baby seems to have a natural affinity for thermals, seeks 'em out, rides 'em high, up where the angels live! To do this, she's turned in flights of one hour or more! Kit complete—add 10c postage 25c

MISS TINY—*Class A*

A 46 inch constant cord edition of the justly famous Pacific Ace. Miss Tiny looks and flies like a real airplane, and behaves almost at your verbal command! She's the No. 1 pin-up gal of every modeler who's flown her, with a string of victories as long as your arm. You'll really go for Tiny.

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45" Wing Spread!

45" wingspread — that's so close to 4 feet it ain't funny! Yes, this is the BIG one you've been looking for!

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60c

Add 10c postage

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GLIDER

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and twice as graceful! She's easy to build, and a honey to fly. Comes down to a perfect landing, and crack-ups are practically unknown. Complete kit—add 10c postage 25c

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Yep, fellers, we have it! 3/16" strands. Now you can get those rubber-powered jobs back into action again!

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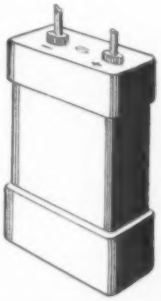

FLIGHT BATTERY $2.75

BOOSTER BATTERY $3.75

TODAY'S SERMON

So you'd like to be "in there" fightin', huh? Well, don't forget this is an ALL-OUT war—and that means home front as well as battlefront. Gather salvage! Save paper! Buy bonds and stamps! That's the way YOU can be in there fightin'!

Modelcraft

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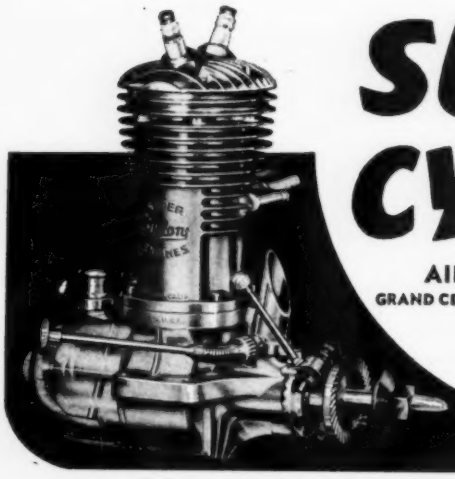

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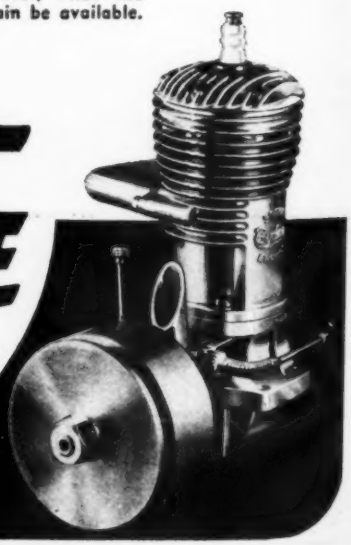

DO YOU HAVE A *Career Problem* TO SOLVE?

TO YOUNG MEN 17
. . . TO JUNE GRADUATES
TO ALL MEN INTERESTED IN AVIATION

Under the stress and strain of war time conditions, this career problem is naturally food for thought and cause for thorough consideration. But after all, the solution should not be difficult if YOU ask yourself these questions:

Shall I take a job, and hope to get ahead? Shall I pursue my normal course, letting fate and the call to military service take its course? Shall I look ahead, prepare myself and take specialized technical training for a future career?

Bearing in mind the great advances in aircraft development which are taking place today, obviously the answer to only one question offers the solution to the career problem—that is,—GET THE BEST TECHNICAL TRAINING AVAILABLE AND GET IT NOW.

For a preview of tomorrow's Age of Flight look at today's opportunity and rapid development in the Aircraft Industry. Then give a thought to the background of the men who are leaders and hold positions of responsibility. These men, you will find, have a foundation of thorough technical training from which they have advanced. Today, thousands of Curtiss-Wright Technical Institute graduates are engaged in all phases of aviation activity, both military and civil. All are making notable contributions to the national war effort.

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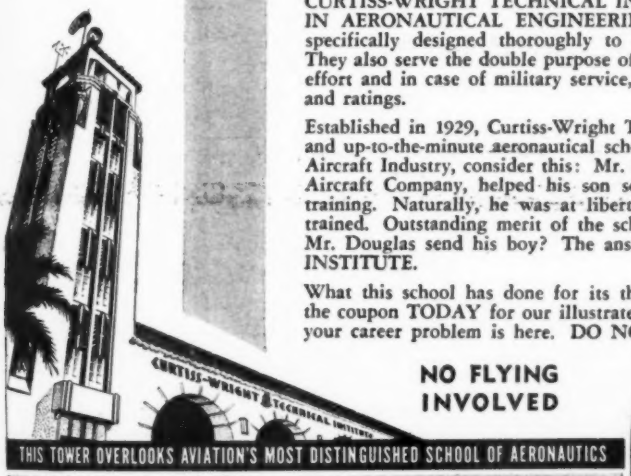
Established in 1929, Curtiss-Wright Tech. is one of the oldest, largest, best-equipped and up-to-the-minute aeronautical schools in America. As to its high standing in the Aircraft Industry, consider this: Mr. Donald Douglas, president of the great Douglas Aircraft Company, helped his son solve a career problem with thorough technical training. Naturally, he was at liberty in his choice as to where his son should be trained. Outstanding merit of the school was the only consideration, and where did Mr. Douglas send his boy? The answer is easy—CURTISS-WRIGHT TECHNICAL INSTITUTE.

What this school has done for its thousands of graduates it can do for you,—send the coupon TODAY for our illustrated catalogue. It's free. The opportunity to solve your career problem is here. DO NOT DELAY. DO IT NOW.



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by **KEITH AYLING**

this gadget

THE inhabitants of Britain were surprised recently to find their streets and countryside littered with small strips of what appeared to be silver paper. They may have thought first some children had been busy with scissors and paper, but the radio quickly warned them that these strips of metal-coated paper were dropped by German night raiders in order to upset the functioning of the British radio-detection devices. The RAF had previously done the same thing over Berlin.

Another British gadget that gave the Germans a headache was the use of small strips of incendiary paper dropped by the RAF over German forests and fields. These moist strips ignited when dried by the air and caused considerable conflagrations, the most memorable being the destruction of hundreds of square miles of the Black Forest, used by Nazis for bomb and fuel storage.

The use of paper strips is just another example of the use of gadgets in air war. Fast and furious they come, seemingly screwball devices, some of which are extraordinarily effective. Who, for instance, but an imaginative dreamer would have visualized the use of sky mines? It sounds fantastic, but airmen flying over Germany report that German planes to which bombs are suspended on cables have appeared. The defenders endeavored to tow these in such positions that the cables become entangled in the allied formations, causing the bombs to explode.

This is an inventor's war both on land and in the air. "Try anything once" seems to be the motto of both sides. Devices that at first sight seem almost crazy are

air war

being put into service.

In the matter of anti-aircraft devices the British tried a strange device, according to German reports. This was a gun which fired a projectile which was in reality a shell with a steel cable spring wrapped tightly around its entire length. When the fuse detonated, the spring unwound just like a clock spring suddenly released, and covered a large area of sky. The idea of the projectile was that the wire would entangle airplane propellers and control surfaces and cause disaster. Of its success little is known, although judging from reports passing through the censors some low-flying craft may have been ensnared by it.

The Germans thought up another: a World War II edition of a weapon used against our night bombers in the last war. This consists of a number of incendiary shells attached to wires. The shells ignite as they leave the gun barrel, and streak upwards. They are intended to catch on the wings of a plane and set it on fire. While engaged on night flying missions in the last war I saw many of these projectiles which we called "flaming onions," but I never met a pilot whose machine had been hit. In this war the "flaming onion" made its appearance in the form of incendiary shells after the style of old-fashioned grape shot. Another German anti-aircraft device is a shell which on bursting becomes a powerful magnesium flare with a parachute attached. This monster illumination is intended to reveal the presence of the night raiders to the anti-aircraft guns and night fighters. A similar device used on raids over England is a bomb dropped from a high-flying bomber. Fitted with a time fuse, this detonates at a predetermined height and burns with a bright glare supposed to impair the vision of defending night-flying pilots. The remedy for this is simple: pilots duck into their cockpits and wait until the glare is over.

Another German device proudly announced by the Vichy radio is a searchlight embodying the principles of infra-red rays, and able to pierce any type of cloud even in pitch darkness. The ray is almost invisible and is proving so successful, says the report, that it is being fitted to a number of FW-190 night fighters. Well, that is something; but on our side we have a gadget which enables our bombers to "feel" the contours of the ground and to sight accurately through

(*Continued on page* 51)

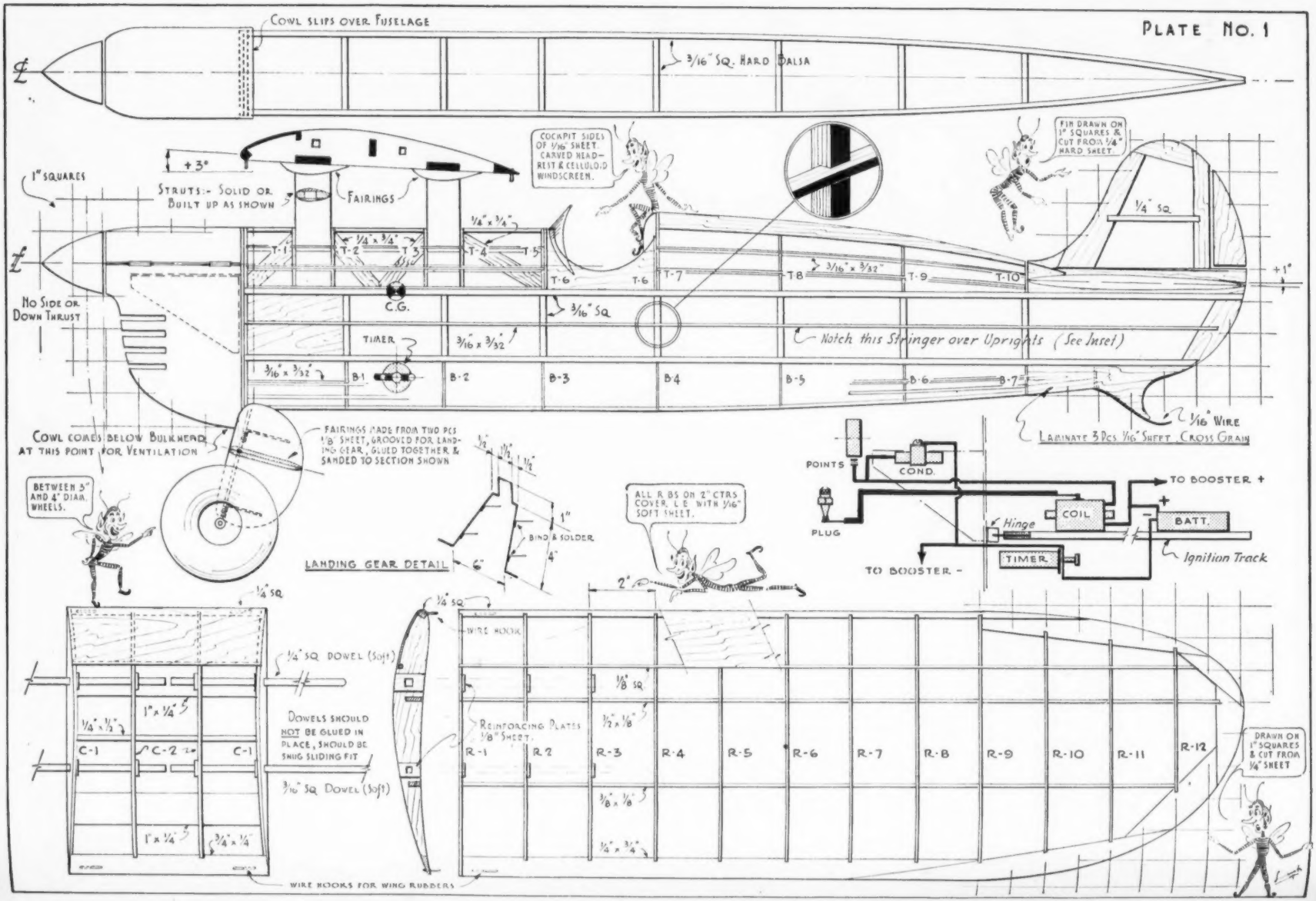


PLATE NO. 1
COWL SLIPS OVER FUSELAGE
3/16" SQ. HARD BALSA
+3°
1" SQUARES
STRUTS:- SOLID OR BUILT UP AS SHOWN
FAIRINGS
COCKPIT SIDES OF 1/16" SHEET. CARVED HEAD-REST & CELLULOID WINDSCREEN.
FIN DRAWN ON 1" SQUARES & CUT FROM 1/4" HARD SHEET.
1/4" SQ
1/4" x 3/4"
1/8" x 3/4"
T-1
T-2
T-3
T-4
T-5
T-6
T-7
T-8
T-9
T-10
3/16" x 3/32"
+1"
C.G.
NO SIDE OR DOWN THRUST
TIMER
3/16" SQ
Notch this Stringer over Uprights (See Inset)
B-1
B-2
B-3
B-4
B-5
B-6
B-7
1/16" WIRE
LAMINATE 3 PCS 1/16" SHEET. CROSS GRAIN
COWL COMES BELOW BULKHEAD AT THIS POINT FOR VENTILATION
FAIRINGS MADE FROM TWO PCS 1/8" SHEET, GROOVED FOR LANDING GEAR, GLUED TOGETHER & SANDED TO SECTION SHOWN
BETWEEN 3" AND 4" DIAM. WHEELS.
LANDING GEAR DETAIL
1/2"
1 1/2"
1"
BIND & SOLDER
4"
6"
ALL RIBS ON 2" CTRS. COVER L.E. WITH 1/16" SOFT SHEET.
2"
POINTS
COND.
PLUG
TO BOOSTER +
COIL
BATT.
Hinge
Ignition Track
TIMER
TO BOOSTER -
1/4" SQ
1/4" SQ DOWEL (Soft)
1/4" x 1/2"
1" x 1/4"
C-1
C-2
C-1
1" x 1/4"
3/4" x 1/4"
DOWELS SHOULD NOT BE GLUED IN PLACE, SHOULD BE SNUG SLIDING FIT
3/16" SQ DOWEL (Soft)
WIRE HOOK
1/8" SQ
1/2" x 1/8"
REINFORCING PLATES 1/8" SHEET.
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
3/8" x 1/8"
1/4" x 3/4"
WIRE HOOKS FOR WING RUBBERS
DRAWN ON 1" SQUARES & CUT FROM 1/4" SHEET

The Falcon

by J. S. LUCK

THE *Falcon* is the outcome of careful adherence to the laws of model aerodynamics.

The ship was originally designed for Class "A" competition. Performance was almost phenomenal. Even now, after nearly two years of hard use, it can and does outfly many of its competitors. It is completely stable and may be flown in tight banking circles without the slightest danger of spiralling in.

The first of the *Falcon* series designed for Class "B" motors distinguished itself by establishing something of a record in its first competition. It stayed in sight for seventy minutes before it was lost for good and that with a six-second motor run on a preliminary test flight.

CONSTRUCTION — First enlarge the plans on thin light-brown wrapping paper, use an H.B. or B. pencil kept constantly sharp. When that is done, melt some grease, bacon fat will do, and spread it over the drawing. This prevents glue from sticking and furthermore renders your efforts transparent, particularly useful for the wing which will be constructed half on one side while the other half will be built on the back of your drawing. Of course, if you believe in making things easier, a few cents will buy a large sheet of regular tracing paper.

Start the fuselage by laying 3/16" sq. hard stock over the top or plan view. Make top and bottom frames one over the other and when set, split apart. Cut seven upright members all exactly 1-7/8" long. Then assemble the basic structure complete with shaped tailstock in place.

Secure bulkhead with plastic resin or casein glue. Attach the remaining formers. Finish the cockpit and headrest fairing.

Before putting in the 3/16" x 3/32" stringers secure the landing gear to the aft side of the bulkhead as shown. Lock washers should be used and, as an added precaution, a sizable quantity of cement over each nut so vibration will never loosen them. Secure the two bolts for attaching firewall firmly in place according to instructions on Plate 2. Install all stringers except those between T-1 and T-5.

Cabane struts are best made up as indicated on Plate 1. They are both stronger and lighter than solid struts so a little extra effort makes them worth while. Make one strut 16" long. After it is sanded to shape, dope and bind with silk or paper and cut into four equal parts. Assemble struts into two pairs, mitered at their bases and glued together to form a "V" with the arms 3-3/4" long, spread 5" apart at the top.

The cabane struts are glued firmly between formers T-1 and T-2 and between T-3 and T-4 respectively. The units are then secured to the 1/16" sheet floor, braced in the location indicated and the whole assembly coated generously with cement.

If the struts are carefully made and well fitted, they will be so strong that nothing short of deliberate sabotage will wreck them and, as a well-made *Falcon* will not have any serious crashes anyway, don't worry about a complicated future repair job.

Complete the fuselage by adding the remaining stringers, tail skid, landing gear fairings, etc.

WING SURFACES—Start by making templates of the wing ribs. This is best done in the following manner:

Lay Plate 3 face down on a sheet of stiff drawing paper, rub over the back of the page with a hard, smooth, object—a toothbrush handle for instance—being careful not to miss the rib outline. Enough of the printing ink will be transferred onto the drawing paper to give a clear image of each section. When these sections are carefully cut out, you will have an accurate and very serviceable template. The advantages of this method are obvious: no inaccuracy from tracing and your copy of MODEL AIRPLANE NEWS will not be mutilated.

The trailing edge is first notched on exact 2" centers with two hack-saw blades bolted together. This will make a cut 1/16" wide. The notches should be 3/16" deep. Do not taper the trailing edge until the wing is complete.

Lay the notched trailing edge in place over the wing outline and pin down after raising the bottom inside edge 1/16". Set the ribs into the trailing edge then cement the 1/4" square leading edge in place. Cut out and assemble the tips. When dry, glue into place raising the extreme tip 1/2" above the trailing edge as shown in the front view of the plane on Plate 3. Lay in the 1/8" square spar and cover the leading edge with soft 1/16" sheet. When the cement is thoroughly dry—at least six hours—remove from the drawing and press the two deep spars into their proper place on the underside of the ribs. Pin the wing down again and allow another four hours to dry.

Note that the trailing edge is not sanded to a knife edge, but is instead almost 1/16" thick, finished off to a smooth radius. This does lower the theoretical

(*Turn to page* 44)

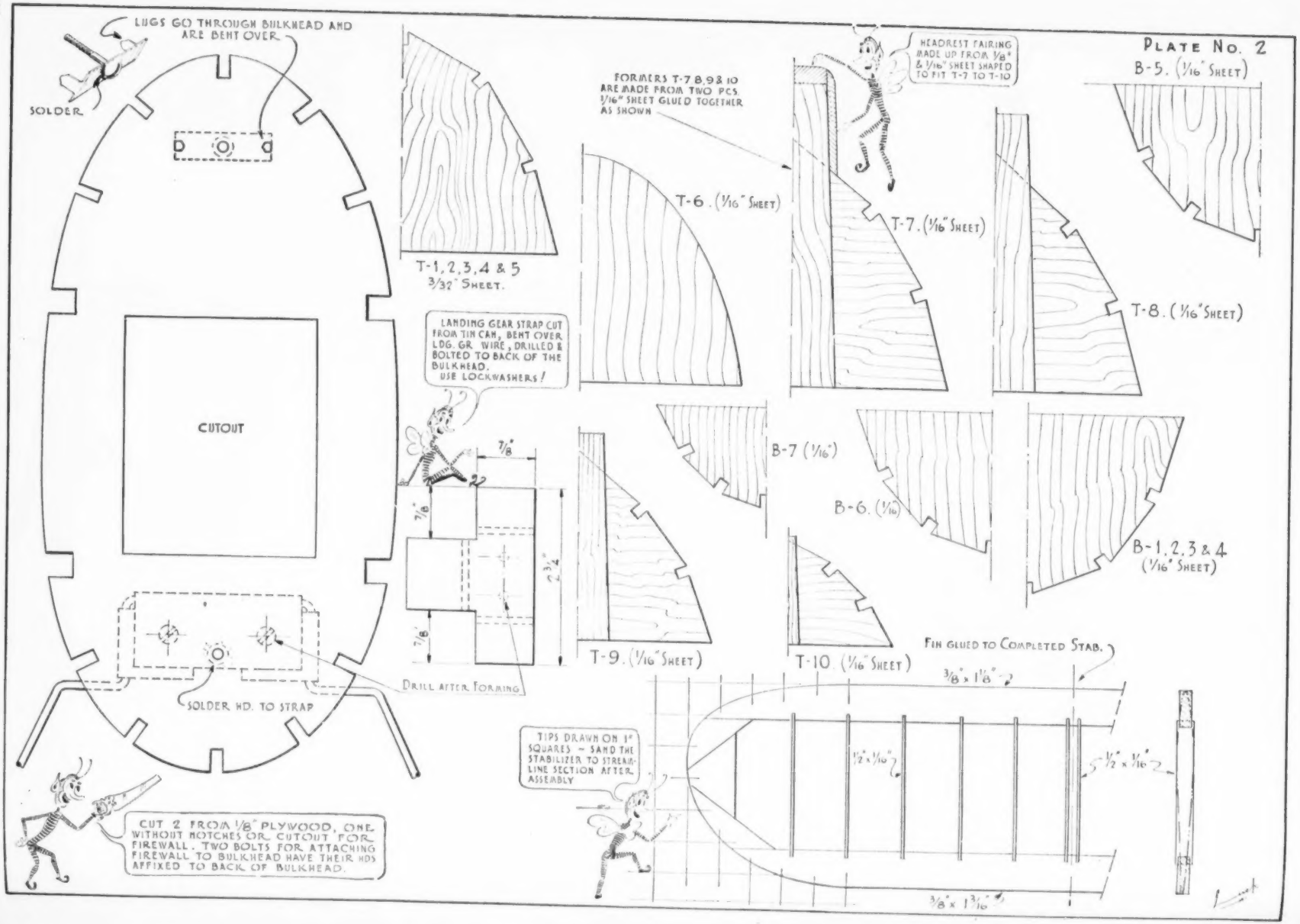


PLATE NO. 2
LUGS GO THROUGH BULKHEAD AND ARE BENT OVER
SOLDER
CUTOUT
SOLDER HD. TO STRAP
CUT 2 FROM 1/8" PLYWOOD, ONE WITHOUT NOTCHES OR CUTOUT FOR FIREWALL. TWO BOLTS FOR ATTACHING FIREWALL TO BULKHEAD HAVE THEIR HDS AFFIXED TO BACK OF BULKHEAD.
T-1, 2, 3, 4 & 5 3/32" SHEET.
LANDING GEAR STRAP CUT FROM TIN CAN, BENT OVER LDG. GR. WIRE, DRILLED & BOLTED TO BACK OF THE BULKHEAD. USE LOCKWASHERS!
7/8"
7/8"
2 3/4"
7/8"
DRILL AFTER FORMING
FORMERS T-7,8,9 & 10 ARE MADE FROM TWO PCS. 1/16" SHEET GLUED TOGETHER AS SHOWN
HEADREST FAIRING MADE UP FROM 1/8" & 1/16" SHEET SHAPED TO FIT T-7 TO T-10
T-6. (1/16" SHEET)
T-7. (1/16" SHEET)
T-8. (1/16" SHEET)
B-5. (1/16" SHEET)
B-7 (1/16")
B-6. (1/16")
B-1, 2, 3 & 4 (1/16" SHEET)
T-9. (1/16" SHEET)
T-10. (1/16" SHEET)
FIN GLUED TO COMPLETED STAB.
3/8" x 1 1/8"
1/2" x 1/16"
5 1/2" x 1/16"
3/8" x 1 3/16"
TIPS DRAWN ON 1" SQUARES - SAND THE STABILIZER TO STREAMLINE SECTION AFTER ASSEMBLY

PLATE No. 3

R-11

R-1,2,3,4,5,6,7,8&9

R-1, 2 & 3 ONLY

1/16"

C-1 ONLY

C-2 ONLY

C-1 & 2

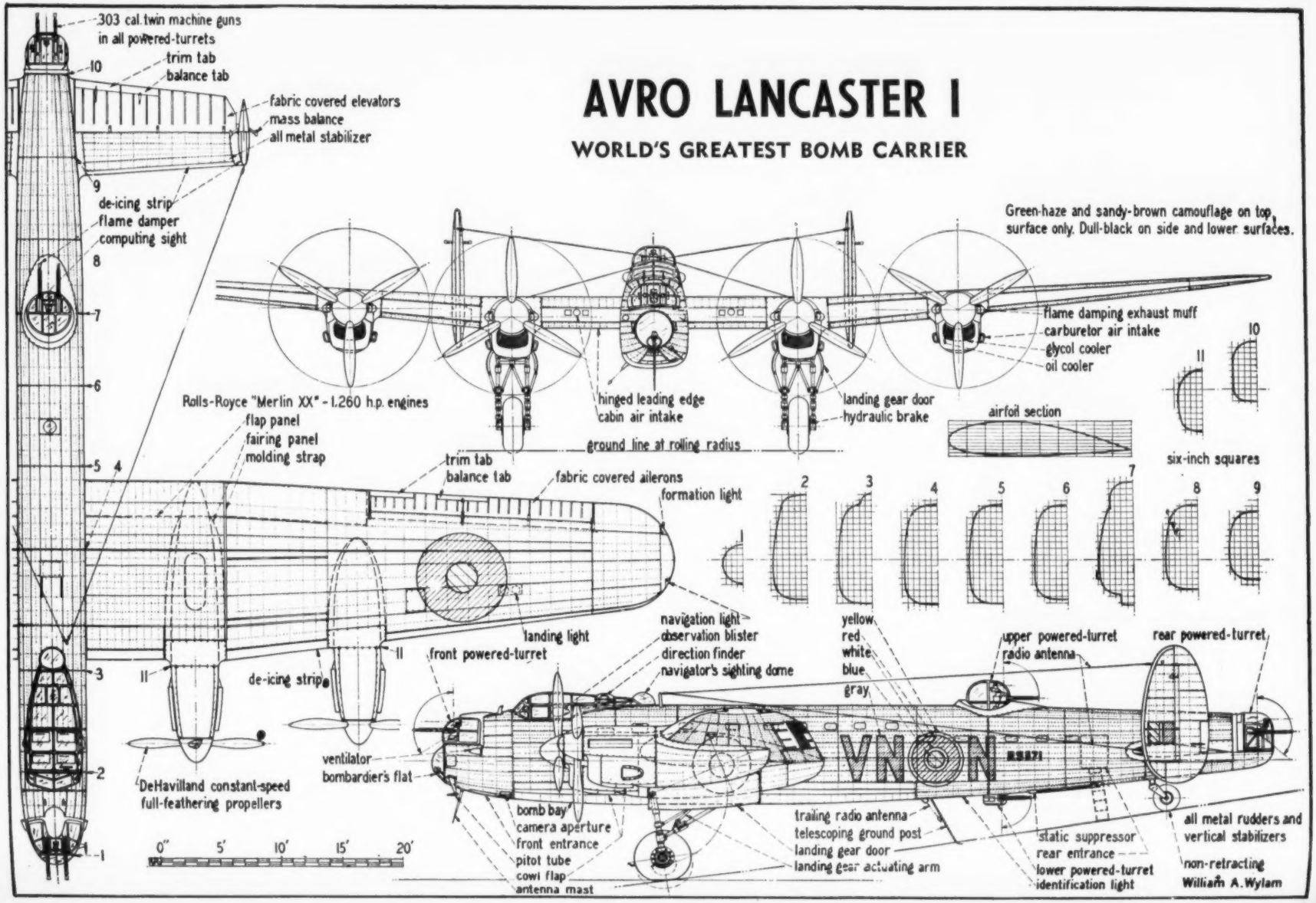
R-10

R-12

4"

PROPELLER BLOCK TEMPLATES (11·5" D. - 7·6" P.)

DESIGNED BY - J.J. LUCK - MOUNT ROYAL MODEL AIRPLANE CLUB
TOWN OF MOUNT ROYAL, QUE. CANADA


AVRO LANCASTER I
WORLD'S GREATEST BOMB CARRIER
303 cal. twin machine guns in all powered-turrets
trim tab
balance tab
fabric covered elevators
mass balance
all metal stabilizer
de-icing strip
flame damper
computing sight
Green-haze and sandy-brown camouflage on top surface only. Dull-black on side and lower surfaces.
flame damping exhaust muff
carburetor air intake
glycol cooler
oil cooler
Rolls-Royce "Merlin XX" - 1,260 h.p. engines
hinged leading edge
cabin air intake
landing gear door
hydraulic brake
ground line at rolling radius
airfoil section
six-inch squares
flap panel
fairing panel
molding strap
trim tab
balance tab
fabric covered ailerons
formation light
landing light
navigation light
observation blister
direction finder
navigator's sighting dome
front powered-turret
yellow
red
white
blue
gray
upper powered-turret
radio antenna
rear powered-turret
de-icing strip
ventilator
bombardier's flat
DeHavilland constant-speed full-feathering propellers
bomb bay
camera aperture
front entrance
pitot tube
cowl flap
antenna mast
trailing radio antenna
telescoping ground post
landing gear door
landing gear actuating arm
static suppressor
rear entrance
lower powered-turret
identification light
all metal rudders and vertical stabilizers
non-retracting
William A. Wylam
0" 5' 10' 15' 20'

LANCASTER I

TODAY he's known as: "Sir Alliot Verdon Roe, M.B.E., retired British industrialist, renowned airplane designer, builder and pilot and the author of a new monetary system for the British Empire." But at the turn of the century he was known as: "A. V. Roe, able-bodied seaman, born April 26, 1877 at Patricroft, Manchester, England, 'has some knowledge of marine engines'." And between those two entries in life's record book lies a story of aviation achievement rarely equalled.

Alliot Verdon Roe studied at Saint Paul's School at Hammersmith and King's College at Strand with a definite aptitude and interest in machinery and mechanics. After college he served as an apprentice at the L. & Y. Locomotive Works. Although he showed definite promise in mechanics, his typical youth's longing for the sea overcame him and he sailed between England and the United States for two years as an engineer. While at sea, he continued his interest in mechanics by inventing an automatic coupler for railway rolling stock. And while at sea his interest wandered, one fateful day, to the Albatross gliding smoothly back and forth over the stern of the ship, keeping a watchful eye on the galley for the messboy to appear carrying a pail. Roe began to think about those Albatrosses and he hasn't to this day ceased to be enthralled by the magic of flight.

He left his ship in England and set to work on his patented coupler while employed by a motor car firm. Disappointed, and growing more fretful over his consuming interest in aviation, he sailed to the United States in 1906 and spent several months in Colorado making drawings for the Davidson Helicopter, which proved a failure. In that year the *Daily Mail* offered a prize of £250 for the first successful model airplane capable of a sustained flight not less than fifty feet. Roe returned to England and built a model airplane powered by elastic. Entered against a field of 200 contenders (the first large model airplane meet) Roe launched his model and watched it fly more than one hundred feet to give him the winner's prize. (No American model airplane contest has offered $1,250 cash as a first prize, so that this contest stands as a record.) Roe resolved nothing would again deter him from airplane design.

Plane on the cover

In 1907 a prize of £2,500 was offered for the first man to fly around the Brooklands Race Track before the end of the year. Roe set to work feverishly and completed his first airplane, a scaled-up version of his winning model. This was a weird looking assembly, consisting principally of a frame structure to which were attached two wings. These wings had no camber but ample dihedral and wing warping was used for lateral control. The craft was powered by a J.A.P. motorcycle engine developing six horsepower! Roe spent many exciting days racing this contraption around the track but it was impossible for him, and very difficult for the spectators, to tell whether or not he was actually flying since when the front of the airplane lifted, the rear of it dragged, and when the rear end rose the nose clung more closely to the ground. This repeated pitching and tossing finally drove him out of the seat one day and he decided, rather brilliantly, that one thing was needed: more power (the principal cause of failure of early designs). He sent to France for one of the successful Antoinette engines of 24 horsepower (four times as powerful as the engine installed).

While awaiting delivery on this new engine, Roe continued his experiments at Brooklands. He rigged up a tow rope to a motorcycle and the plane soared into the air like a gull, proving that it was, indeed, capable of flight provided sufficient power was available. His difficulties didn't desert him, however, as his pal on the motorcycle just couldn't seem to release the rope at precisely the right moment and still concentrate on his cycling around the track. Frequent crashes were discouraging but Roe had proved to himself that his machine *could* fly.

Avro 504K was standard World War I trainer.

Finally, the new engine arrived and was installed. On June 8, 1908, A. V. Roe soared faultlessly into the air in his machine, under its own power, to span the magnificent distance of some 60 yards at an altitude of approximately three feet! But his flight was one in kind, if not in degree, and on that historic day he became the first man to make a flight in England. This, just four and a half years after the Wright Brothers' first successful performance. Shortly afterwards, he left Brooklands and installed his equipment in new quarters, there to begin his famous Lea Marshes experiments.

Roe was a true experimenter and deliberately sold the Antoinette engine, as he firmly believed putting that much power into an airplane was "cheating" and the true test of the designer's skill was to fly with the minimum power necessary.

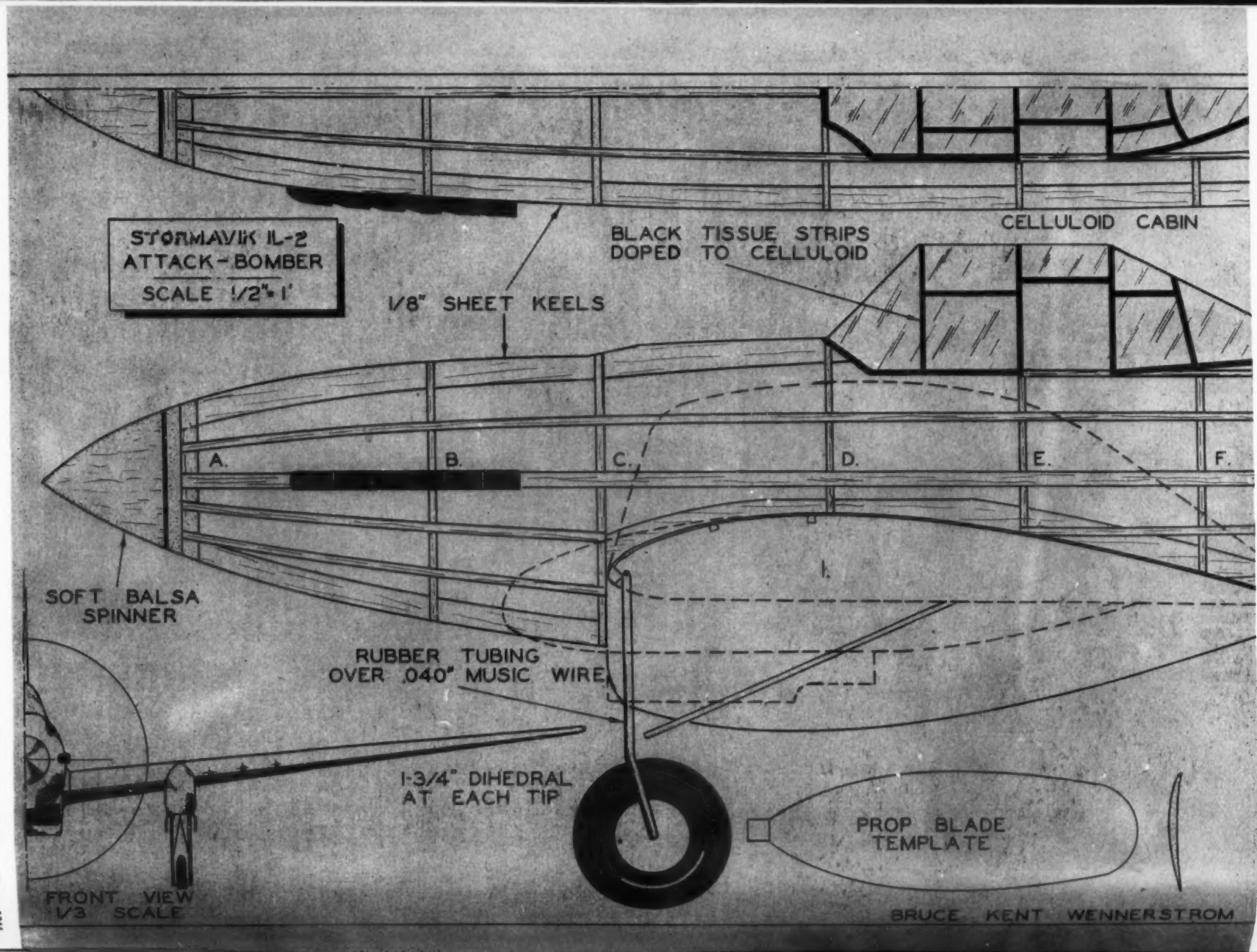
In 1909 he designed and built his famed *Bull's Eye Aeroplane*, a craft with triplane wings and tail, powered by a nine horsepower J.A.P. motorcycle engine. After flights as long as 300 yards, a 14 horsepower engine was fitted and the performance increased accordingly, with many successful flights at Wembley Park.

The following year Roe built two more triplanes, one fitted with a 30 horsepower J.A.P. engine and the other with the new Green water-cooled engine of 35 horsepower. These machines were flown successfully at Brooklands and at Wembley.

In August, 1910, Roe brought his triplane to the United States to participate in the huge aviation exhibition and flying meet at the Boston-Harvard aviation field, Atlantic, Massachusetts, near Boston. On September 8, 1910, he met with a mishap and the machine was utterly demolished but Roe, as seemed usual at the time, escaped unhurt. This marked the first flight of a triplane motor driven machine in the United States. (Octave Chanute flew several triplane gliders in 1901 and 1902.)

Being thoroughly convinced of the success of his planes and the possibility of selling them, Roe debated long and ar-

(*Turn to page* 60)


STORMAVIK IL-2
ATTACK-BOMBER
SCALE 1/2"=1'
1/8" SHEET KEELS
BLACK TISSUE STRIPS
DOPED TO CELLULOID
CELLULOID CABIN
A.
B.
C.
D.
E.
F.
SOFT BALSA
SPINNER
RUBBER TUBING
OVER .040" MUSIC WIRE
1-3/4" DIHEDRAL
AT EACH TIP
PROP BLADE
TEMPLATE
FRONT VIEW
1/3 SCALE
BRUCE KENT WENNERSTROM

SOVIET STORMAVIK

by **BRUCE KENT WENNERSTROM**

NEMESIS of German tanks on the Russian front is the Soviet *Stormavik* IL-2. Without doubt it is the most heavily armored single-seater fighter-plane in service. With the exception of control surfaces, covering is all-metal. Pilot and engine are adequately protected by 8 mm armor plate. There are two versions of the ship: a single seat attack-bomber (IL-2) and a two-place fighter-bomber (IL-3), the second occupant being a rear gunner. Either version may be built from the accompanying plans. Like all Russian planes, there is very little information available on the *Stormavik* other than the specifications shown at right.

Our model was built to the exact scale of 1/2"=1'. The only deviation is an enlargement of tail surfaces to insure stability and good flights. The original model was built entirely from balsa with the exception of the trailing edges of the wing and stabilizer which were pine.

SPECIFICATIONS
Stormavik IL-2

Span	49'0"
Length	38'6"
Engine	AM-38-1, 300 hp
Maximum Speed	280 mph
Designer	Sergei Iliuchin
Tactical mission	ground attack
Armament	8 rocket-bombs
	2 32 mm cannon
	4 7.7 mm machine guns

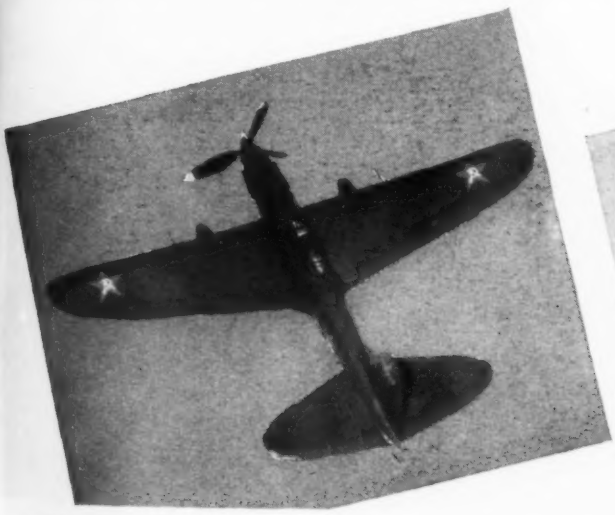
Balsa is naturally the best wood, but you will probably have to build most of your model from hardwoods. In selecting substitute hardwood, the cross-sectional area of the hardwood should be half the cross-sectional area of the balsa size called for. By following this rule a model may be built exclusively of hardwood with only an 8% increase in weight.

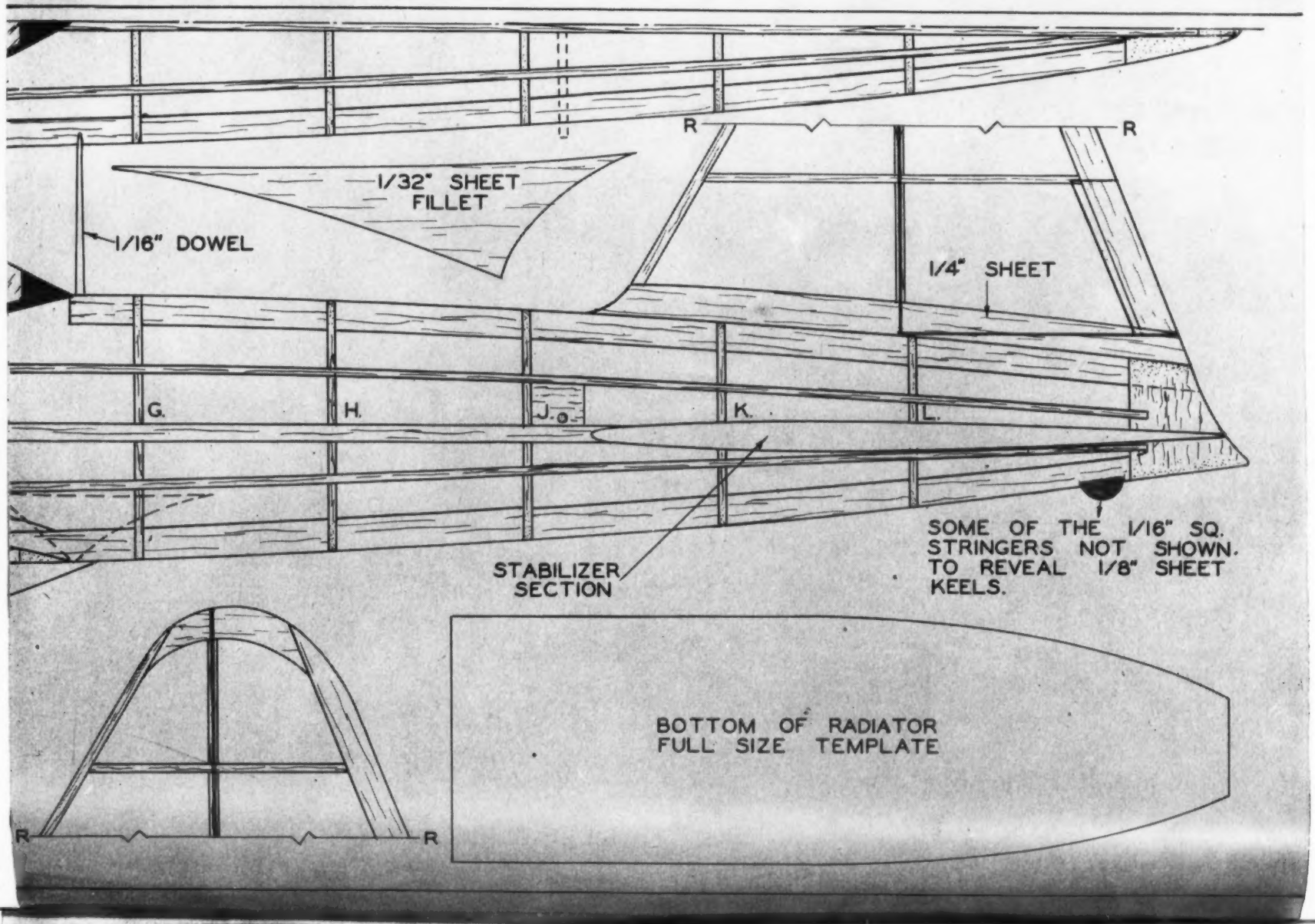
FUSELAGE—Keel construction is the method used to make the fuselage. It is a quick, easy, and accurate way of building a circular or oval cross-sectional fuselage for rubber models. First make the keel pieces. Trace top and bottom outlines of the side view on 1/8" sheet balsa. Make side keels in a like manner. The bottom keel is composed of three pieces, the top keel two, and the side keels are in one piece. The average depth of the keels is 3/16" to 1/4".

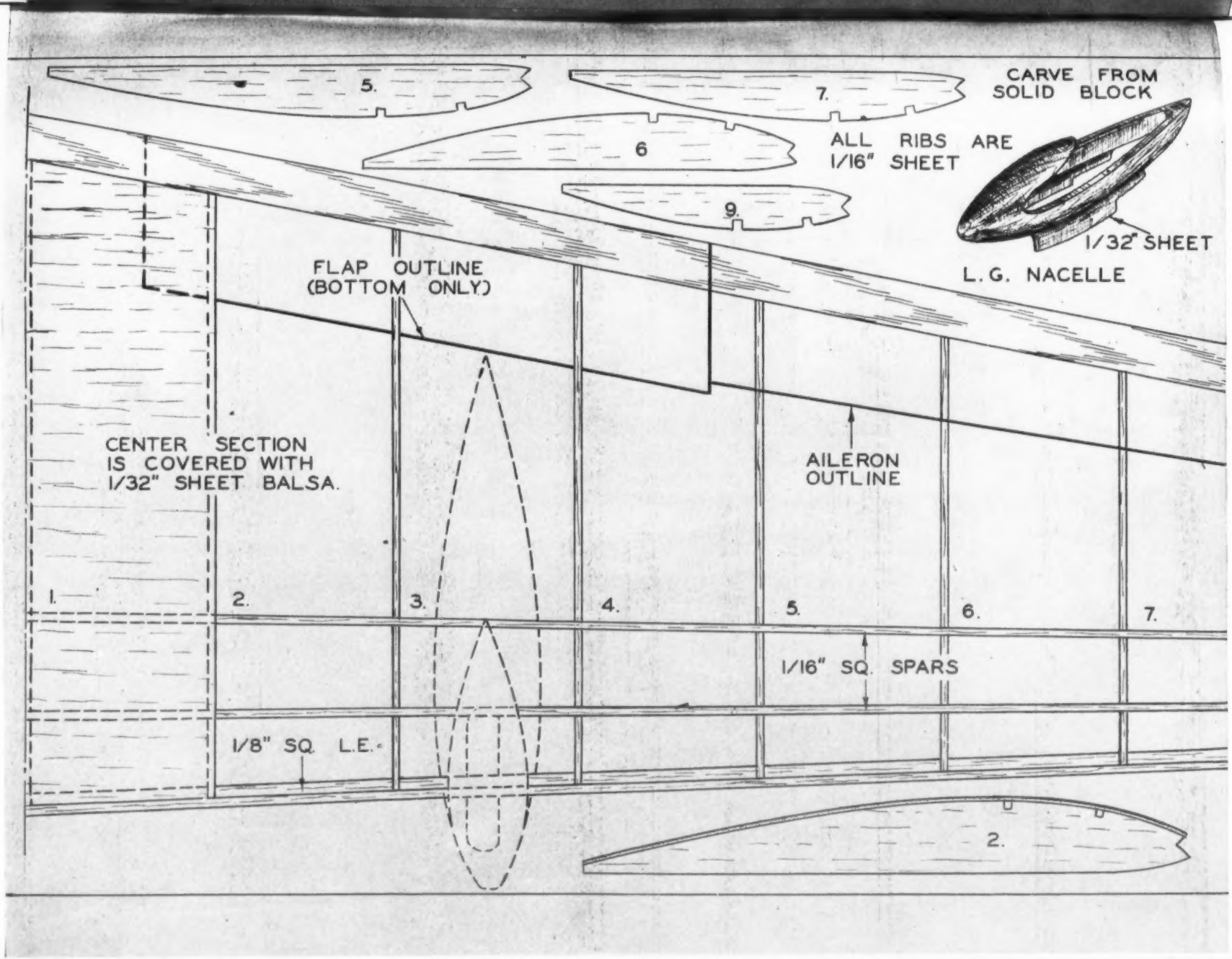
Formers are shown full size on the plans. With the exception of the nose block A, which is two pieces of 1/8" sheet balsa laminated, the formers are all cut from 1/16" sheet balsa. It is advisable to simply mark the stringer positions, notching the bulkheads just before adding the stringers. Cut the keel notches and mark the stringer positions.

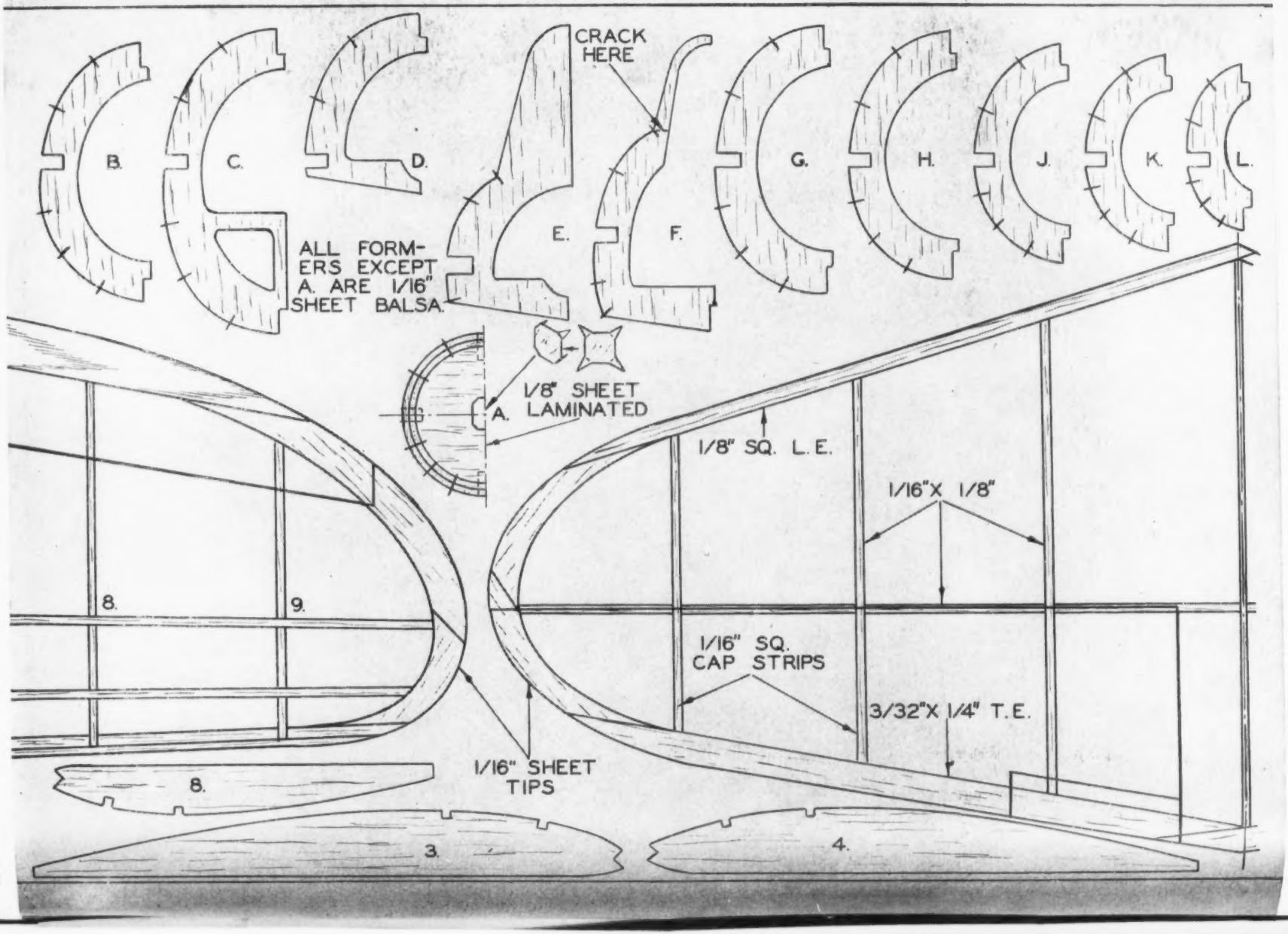
To begin actual fuselage assembly cover the plans with wax paper to keep ce-

(*Turn to page 47*)




R
R
1/32" SHEET FILLET
1/16" DOWEL
1/4" SHEET
G.
H.
J.
K.
L.
SOME OF THE 1/16" SQ. STRINGERS NOT SHOWN. TO REVEAL 1/8" SHEET KEELS.
STABILIZER SECTION
R
R
BOTTOM OF RADIATOR FULL SIZE TEMPLATE

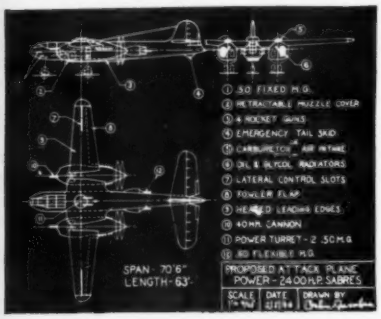

5.
7.
6
9.
CARVE FROM SOLID BLOCK
ALL RIBS ARE 1/16" SHEET
1/32" SHEET
L.G. NACELLE
FLAP OUTLINE (BOTTOM ONLY)
CENTER SECTION IS COVERED WITH 1/32" SHEET BALSA.
AILERON OUTLINE
1.
2.
3.
4.
5.
6.
7.
1/16" SQ. SPARS
1/8" SQ. L.E.
2.


B.
C.
D.
CRACK HERE
E.
F.
G.
H.
J.
K.
L.
ALL FORMERS EXCEPT A. ARE 1/16" SHEET BALSA.
1/8" SHEET LAMINATED
A.
1/8" SQ. L.E.
1/16"X 1/8"
8.
9.
1/16" SQ. CAP STRIPS
3/32"X 1/4" T.E.
1/16" SHEET TIPS
8.
3.
4.

DESIGN FORUM

Analysis and discussion of ideas submitted by readers

WE HAVE received a multitude of letters inquiring about the absence of *Design Forum* in the past few issues and we appreciate this evidence of interest. In apology, we might point out that *Air Age, Inc.* is cooperating 100% with the War Production Board's paper regulations and under the various rulings we cannot add any pages or print any additional copies. This means, simply, that the editorial

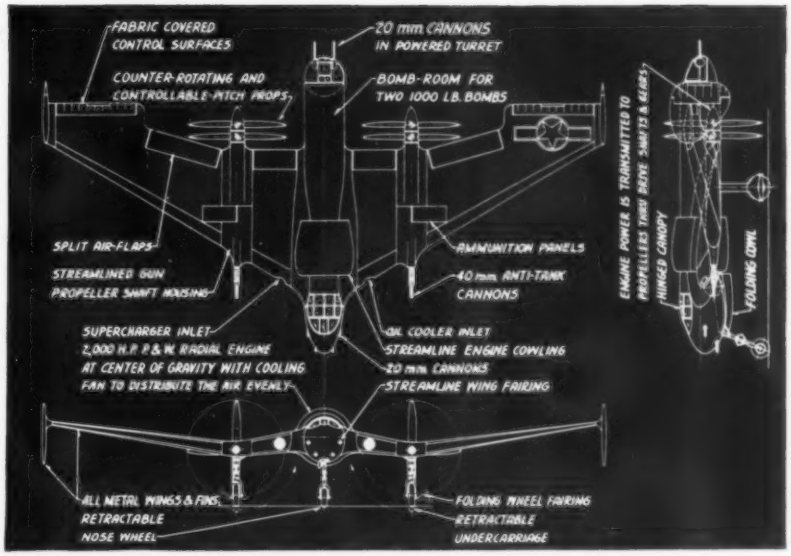


No. 2 Attack plane design by O. Jacobson

pages of the magazine are a set number which cannot be increased.

We have hundreds of interesting, scientific articles and drawings we want to present each month and from these the Editor can select only a small number, usually the best and most timely. In order to present a wider selection of material, he has been forced to rotate certain features, such as *Design Forum*, *Aeronautical Science*, *World War I Album* and others and, in consequence, these features appear intermittently rather then regularly. We believe, and letters from readers would indicate, that the rotation of these departments gives a greater variety of subjects and an increased interest in our work. We'd like to hear from you on the subject, though. Why not drop the Editor a line?

Design No. 1, this month, is the work of Freddy Michael and illustrates an original approach to the problem of drag reduction. The engine, a Pratt & Whitney double-row radial of 2,000 hp, is located within the fuselage aft of the pilot and is cooled through the use of an annular ring and internal fan. The location of the engine is satisfactory, but the cooling difficulties would be enormous due to the presence of high turbulence at the intake region. A better location is the wing leading edge where the undisturbed flow could be gathered into ducts and routed into the engine compartment. In the latter installation a cooling fan would be a definite aid but the use of a fan in the present


FABRIC COVERED CONTROL SURFACES
20 mm CANNONS IN POWERED TURRET
COUNTER-ROTATING AND CONTROLLABLE-PITCH PROPS
BOMB-ROOM FOR TWO 1000 LB. BOMBS
ENGINE POWER IS TRANSMITTED TO PROPELLERS THRU DRIVE SHAFTS & GEARS
HINGED CANOPY
FOLDING COWL
SPLIT AIR-FLAPS
AMMUNITION PANELS
STREAMLINED GUN PROPELLER SHAFT HOUSING
40 mm ANTI-TANK CANNONS
SUPERCHARGER INLET
2,000 H.P. P & W. RADIAL ENGINE AT CENTER OF GRAVITY WITH COOLING FAN TO DISTRIBUTE THE AIR EVENLY
OIL COOLER INLET
STREAMLINE ENGINE COWLING
20 mm CANNONS
STREAMLINE WING FAIRING
ALL METAL WINGS & FINS
RETRACTABLE NOSE WHEEL
FOLDING WHEEL FAIRING
RETRACTABLE UNDERCARRIAGE

No. 1 Freddy Michael's tailless pusher with twin props and buried engine features

installation seems needless. At fairly high speeds, ram pressure would provide adequate cooling, as in the original Vultee *Vanguard* and the Curtiss XP-42, both of which featured internal cooling successfully.

The problem of airplane power plant design is fundamentally a problem in the handling of air. Enormous quantities at high pressure are required to provide carburetor air for the engine, cooling air for the engine and cooling air for the engine oil system. The simplest solution is to take in air at the front of the airplane or wing where the flow is smooth, fast and adequate. The use of air intakes, however, introduces problems of drag which are of primary importance in some designs. In the case of the *Mustang*, the drag problem indicated the location of the air scoop along the belly of the airplane far aft of the nose. This is a poor location from the standpoint of air intake but a good one from the standpoint of drag reduction. With the use of high boiling point cooling fluids in the Allison engine, the quantity of air required for cooling is markedly reduced, being much less than that quantity required for an air-cooled engine. However, lubricating oil does not have such a high boiling point and, in the case of the *Mustang*, *Lightning* and *Warhawk*, the major portion of the air is used for oil cooling.

With the radial air cooled engine, cylinder head temperature is controlled directly by air flow but may be controlled indirectly by oil cooler flow. An air cooled engine with spacious cooling facilities needs very little oil cooling. However, it is possible to operate an inadequately cooled engine with spacious oil cooling facilities, the latter carrying the brunt of the heat transfer.

The pusher installation is undergoing extensive experiment and several designs of a confidential nature are being flown today. However, it would appear that the problems are too complex to warrant an

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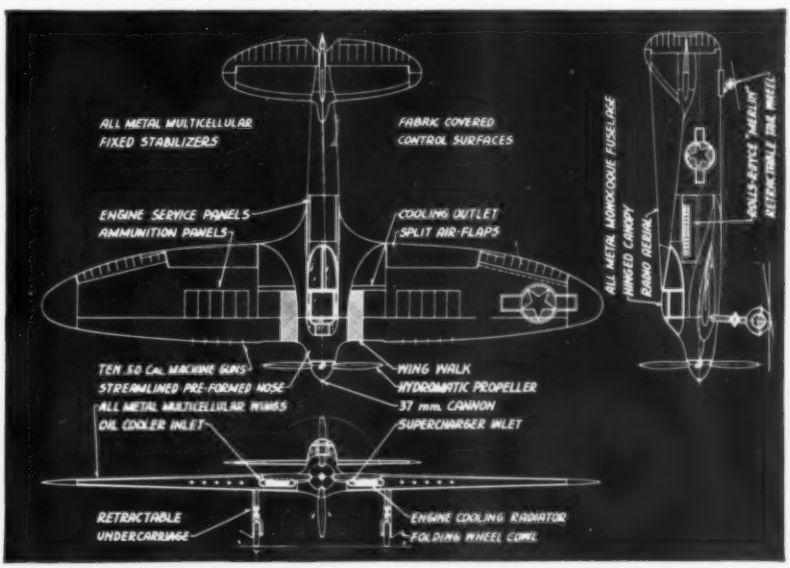


No. 3 A beautifully designed single-seat fighter with propeller extension shaft by Dick Lyons

AIR AGE FRONTIERS

Jet black and deadly is the Douglas P-70 night fighter. Belly housing contains four 20 mm cannon. Developed for South Pacific

Waco CG-13 transport glider is largest ever built. Accommodating light truck, supplies, personnel, it may play invasion role

Latest *Warhawk* model is this P-40N now in South Pacific action. Allison engine is used and belly tank gives increased range

Captured Junkers Ju88-A6 is given a "going over" by British mechanics. Captured equipment is test flown to reveal performance

Captured Focke-Wulf Fw-190A3 carries rocket launching racks. Allied pilots claim it best of the enemy, approach it carefully

Latest version of Hawker *Typhoon* IB with single piece formed plastic enclosure. *Typhoon* is fastest, most powerful British fighter

Vought *Corsair* I is used in action by Fleet Air Arm carrier-based squadrons. Large numbers are in U.S. for training purposes

By popular request we present a page of training planes. Here is the Naval Aircraft Factory N3N-3 *Canary* used by Naval Aviation

Vultee BT-13A is early model of standard basic trainer used by Army Air Forces Training Command. Some plastic models produced

Stearman PT-17 in new silver paint adopted by AAF Training Command. Same plane used by Naval Aviation as the N2S-1 and N2S-3

Bill Good with complete control system: transmitter, receiver, control and antenna

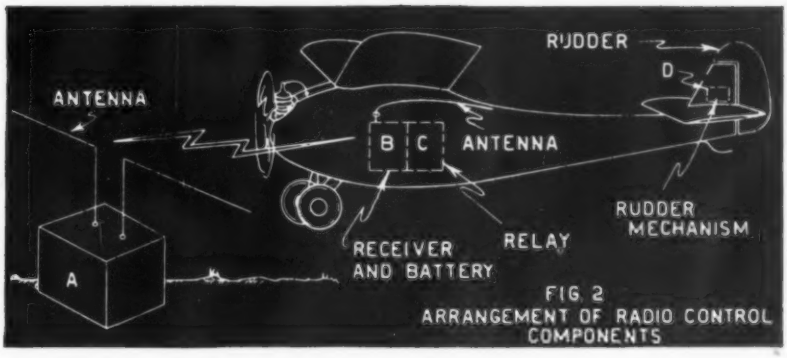


FIG. 2
ARRANGEMENT OF RADIO CONTROL COMPONENTS

Fundamentals of
RADIO CONTROL

by **BILL** *and* **WALTER GOOD**

RADIO control of a model plane is a new and fascinating hobby. Every modeler dreams of controlling his own models and at last that dream is a reality. Just imagine landing your own model plane a few feet from the takeoff. That's a real thrill—especially when *you* are doing the controlling.

Proof that radio control is really here comes from all parts of the country, several radio controlled thermal flights of over an hour are reported from Florida. Two Michigan fellows have looped their eight foot radio-guided plane. A lad in the East can spin his plane—and make it recover—another plane has been controlled two miles away. Others have demonstrated the figure-of-eight maneuver and spot landings so close as to almost bowl over the controlling radio transmitter. There's no chasing of models for these fellows!

Probably the first radio controlled flights of gas powered models by model plane builders were made during 1937, so this hobby is not half as old as that of gas jobs. Early radio flights were characterized by the comment of one radio controller, "Well, the plane landed in a different place from what it would have if it hadn't been under control"! Meaning that the path of flight had been diverted but not necessarily as planned. Some of the present day radio controllers can land their models within a 25 foot radius most of the time. Consequently, the radio control contest of today is judged mainly on the model's maneuvers.

The operation of a radio control system is simple. Fig. 1 shows the basic radio control system. A radio transmitter (A) on the ground sends a radio signal to the receiver (B) in the plane. The receiver causes the sensitive relay (C) (effectively a switch) to close and operate the control (D) which moves the rudder making the model turn. Fig. 2 shows a typical arrangement of these components in the controlled model. The complete radio control equipment usually weighs from one to two pounds, resulting in a ship weighing from five to fifteen pounds.

Almost standard for the receiver (B) is the one-tube superregenerative type built to work on a five-meter wave length. Extremely high sensitivity, broad tuning and freedom from ignition interference are the much desired characteristics of this type of receiver. Radio control builders have developed this receiver to such a high degree that some weigh only three ounces! The radio batteries needed are one 45 volt battery and one or two flashlight cells. Small 45 volt batteries, formerly expensive and difficult to obtain, are now available in a large variety due to the advent of the small portable radio. Battery weights vary from one-half pound to one pound depending upon their capacities.

One of the most critical parts of the radio control plane is the sensitive relay. Success of most present day radio models hinges on its positive action. This relay must function on currents of less than one-thousandth of an ampere! Indeed a stringent requirement considering the fact that it must also be light in weight and unaffected by the ship's vibration. Commercial relays weigh from one to four ounces. Many fellows find that good relays for this purpose can be homemade.

The control mechanism whose duty is to move the rudder flaps, advance the motor or to execute any other operation, appears in numerous forms. Most used is either the small electric motor with a gear train or the rubber band escapement. Both require several flashlight cells for operation. The rubber band escapement is light in weight—as little as one-half ounce—and fast in acting, but must be wound before each flight. The electric motors are slow moving but powerful.

Transmitters are usually of the 5-meter portable variety. The person who operates the transmitter must have an amateur radio license. Therefore most model airplaners have an interested radio amateur assist them. Radio control is more than a one man job. Consequently a radio man and a modeler make an excellent combination. It should be pointed out that wartime restrictions prevent transmitter operation thus disallowing radio control operation. However nothing

(*Turn to page* 36)

Walter Good with 8 ft. radio controlled model. Receiver and relay inside fuselage

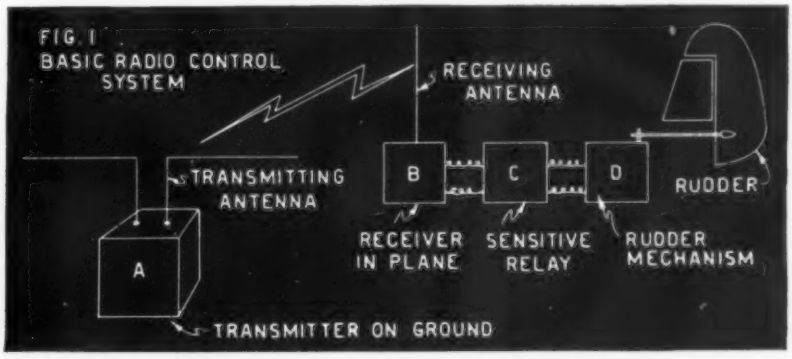


FIG. 1
BASIC RADIO CONTROL SYSTEM

AIR WAYS

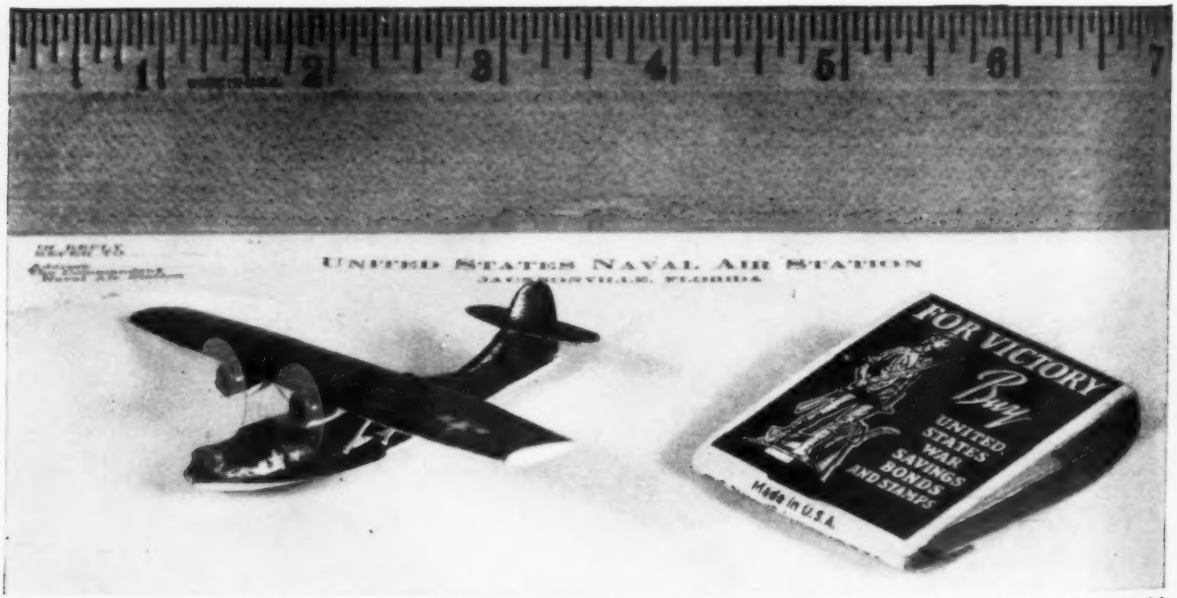
No. 1—Joseph P. Kochis built this detailed Republic P-47 *Thunderbolt* made from a kit but sheet covered with extra details

No. 2—A tiny Bell *Aircobra* by George Conklin of Los Angeles. Note pin size.

News of model plane experimenters from all parts of the world

MANY readers have noticed our monthly question: "What do you like best in this issue? We are anxious to publish the features *you* want to read. Drop the Editor a line." We have received quite a response to this and many of the comments have been very interesting. As a matter of fact it was due to your answers to this question that "Air Ways" is now back in its original form with text matter containing stories of the different models.

Many of our regular readers objected strenuously to the "Air Ways" columns in the January and February issue con-

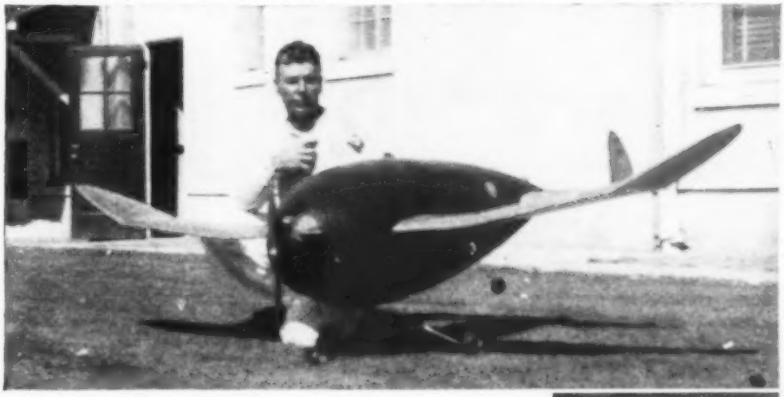


No. 3—Expert miniature builder Allan F. Kitchel, Jr., is now a Navy Lieut. but found time for this Consolidated PBY *Cat* model

No. 4—At left is Bill Oates' Consolidated *Liberator* built from plans in M.A.N. No. 5 at right shows Bill and his products

taining only photographs and since the letters indicated a unanimous opinion that stories of the models should be printed along with the photographs, we promptly reinstated the text you are now reading. This is an example of just what we mean when we say that this is *your* magazine. It always has been and always will be in the form, contents and style that you demand. The Editor is merely the instrument through which you dictate your views on how MODEL AIRPLANE NEWS can best serve your needs. So please take our little notice seriously and let us hear from you—every month if you can spare the time—and we'll certainly follow through.

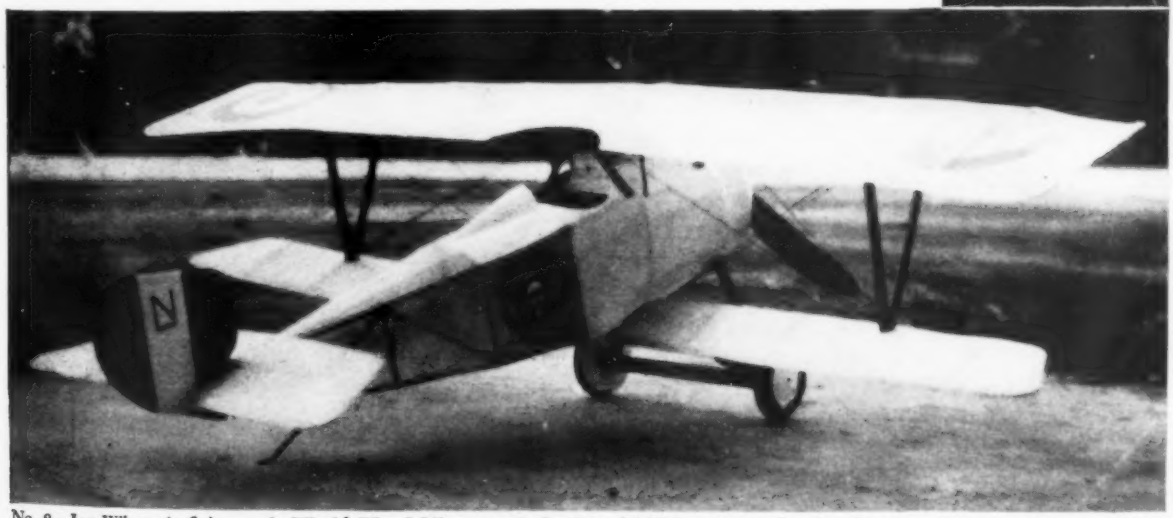
Picture No. 1, at the head of the department this month, comes from Joseph P. Kochis, 222 16th Street, N.W., Barberton, Ohio, and shows his Republic P-47 *Thunderbolt* scale job. He writes: "Fuselage was constructed by using the formers supplied with the kit. These were cut 1/16" undersize on the outer perimeter and cover with 1/16" balsa. No stringers were used. While the formers were in the jig normal to the centerline they were partially covered with sheet then removed. The fuselage was made in two halves in this manner, then cemented together. The wings are covered completely with 1/16" sheet balsa. The tail surfaces are paper covered. The flaps are movable and the motor is completely detailed. The cockpit interior is not complete because of the dummy pilot. The landing gear is fixed and the entire model is built to a scale of 3/4" to the foot."



Picture No. 2 requires a little careful comparison before the true minute size of George Conklin's Lockheed P-38 *Lightning* model can be appreciated. The picture is actually *more* than lifesize, as a comparison with the push pin will reveal. George built a complete set of this model from Lilliput including a Bell *Aircobra* and a Douglas *Havoc*. He writes: "The planes are made out of balsa wood and match sticks and only a razor blade, a pocket knife and sandpaper were used. Getting a decent picture of these models turned out to be almost as big a job as

(*Turn to page* 38)

No. 6—Above is the original fuselage designed by Prof. John Hodgdon, shown in No. 7 at the right. Motors are mounted in nose and tail.

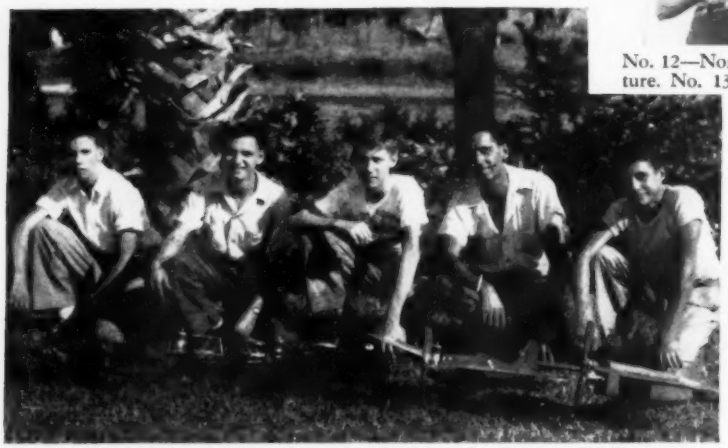


No. 8—Joe Wherry's flying scale World War I Nieuport 27 C.1 is a faithful replica and a fine flier. Joe was an officer in artillery

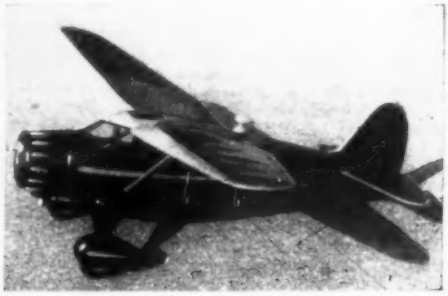
No. 9—Douglas SBD *Dauntless* detail scale job should be accurate. Bob Johnson, No. 10 at right, works on them in the Navy

No. 11—Captain Carlos Dodd built this Republic *Thunderbolt*

No. 12—Norman Deitchman and his original design make nice pic ture. No. 13—Lt. N. P. Witte (right) was "bitten" after layoff

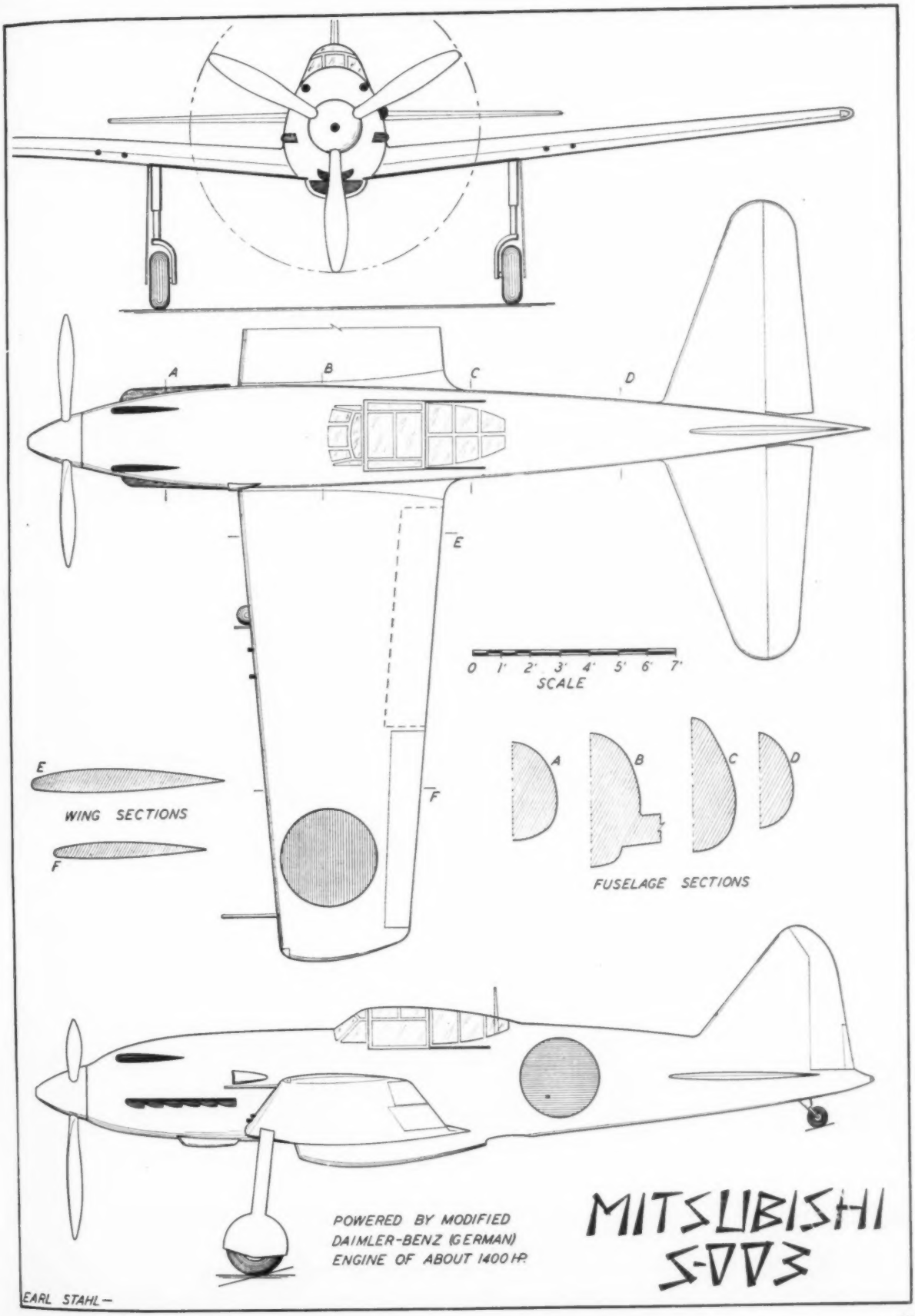


No. 14—The Saint Petersburg Model Club and collection of G-lines



No. 15—Stinson *Reliant* is product of Floyd Gambler Jr., and has new type engine control unit

No. 16—Beautiful trick shot by scale modeler LeRoy Hubbard of his Bell *Aircobra*. He plans a *Fortress* scale job with 6½' span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SCALE
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WING SECTIONS
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FUSELAGE SECTIONS
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DAIMLER-BENZ (GERMAN)
ENGINE OF ABOUT 1400 HP.
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SCIENCE

How to perform a simple stress analysis of your model airplane wing

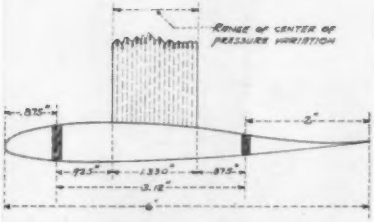


FIG. 1 Center of pressure travel on typical model wing section

STRESS YOUR GAS JOB

by

J. P. EAMES *and* **W. L. NYE**

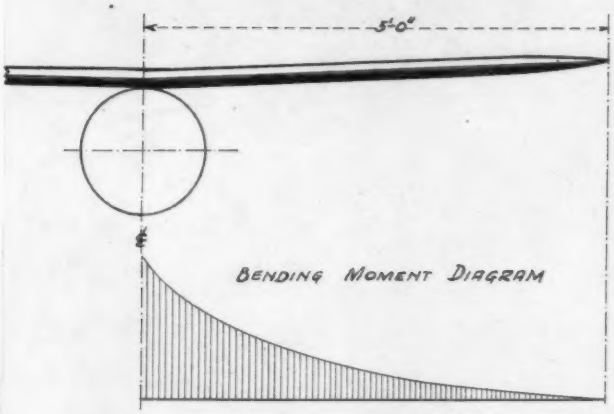


FIG. 2 Bending moment diagram for model airplane wing spar under normal loading and within allowable strength

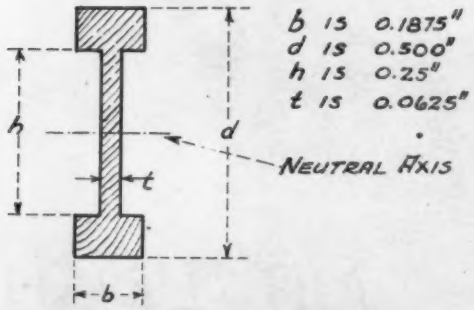


FIG. 3 Cross section of typical model airplane wing spar of the "I" beam type giving strength

WING ANALYSIS

THE primary function of the wings is to generate the lift forces which provide the sustentation for the model airplane. The dimensions of the wings are large and the weight must not be excessive if high performance is desired, thus it is mandatory that a high structural strength-to-weight ratio be attained.

In addition to the normal flight loads imposed upon the wing structure, additional loads are imposed upon the wings by wind gusts and maneuvers. Flight maneuvers tend to augment the static or dead weight load of the wings. From the foregoing premise, it is evident that a simple stress analysis of the wings of a model airplane is in order. Simple static tests may also be performed in order to substantiate the stress analysis.

The methods of wing stress analysis vary with differences existing in the types of wing construction and the types of model airplanes. Perhaps the reader may be anticipating the construction of a model biplane with interplane strut members, or again, the reader may be faithfully reproducing the outlines of a cantilever monoplane. Some model builders may favor the use of a

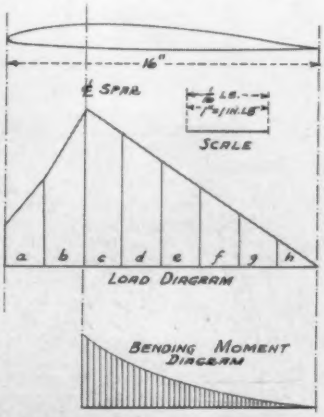


FIG. 4 Chordwise load distribution and moment diagram for a typical model airplane wing rib

single spar cantilever wing. Others may cling to the use of a conventional two spar wing structure, or some variation thereof. All of the variations of wing structure have a definite reason for use, and each possesses certain specific merits.

Wing Loads

The two primary loads imposed upon the structure of the wing are impact loads because of rough landings and aerodynamic loads. Few model wing structures fail in flight because of aerodynamic loads, mainly because almost all model aircraft wings are considerably overstrength. However, overstrength in the structure in many instances tends to add excess weight and impair performance. Whenever possible, the wing structure should be analyzed for primary bending loads. This is necessary to attain a high strength-to-weight ratio, and to delete excess material.

Bending loads are normal loads, and are resolved into the running load imposed along the wing spars. Impact loads are resisted by the joints of material within the allowable strength. Joints of wing spars are cemented or doweled. The loads caused by impact must be resisted by the shear strength of the cemented or doweled joints.

Torsion loads are caused by the slipstream and rough air conditions. Such loads are usually of insignificant magnitude and need not be analyzed, provided a reasonably strong system of drag bracing or structural ribs are part of the wing structure. Combined bending and torsion loads seldom attain a magnitude sufficient to distort the model wing greater than the limits of the elasticity of the wing structure.

From the previous analysis, it can be seen that the theoretically ideal model airplane wing structure would be one that has the highest strength-to-weight ratio combined with a sufficient margin of safety to withstand the normal bending loads and, in addition, be reasonably strong against the impact loads imposed by rough landings. To attain this ideal simple stress analysis may be used to advantage.

WING ATTACHMENT—The fittings by which the wing is attached to the model airplane fuselage are usually designed in such a manner that a rough landing will tend to shear the fastenings to the fuselage and so absorb the impact loads caused by the rough landing. In this manner, extensive damage to the wings is prevented. The strength of the fuselage, in almost all types of model airplane construction, is in considerable excess to that necessary to react to the various air loads imposed upon the wing. Therefore, the loads at the wing fittings may be disregarded and no analysis is necessary.

IMPACT LOADS—In this article so far, impact loads have been frequently referred to. The impact loads are far in excess of air loads, being 4 and 5 times that of the air loads.

The simplest method of considering impact loads is to weigh the model airplane structure, complete with fuel and all equipment. The weight should be interpolated into pounds, although for accuracy, the actual weighing should be done in ounces.

In order to determine the impact loads, it is necessary to estimate the highest landing speed to which the model airplane will be subjected. This is somewhat of a guess, but it may be reasonably assumed to be between 10 to 15 miles per hour. These quantities should be interpolated into feet per second. When this is done, these quanties should be multiplied by the weight which gives a quantity of foot pounds per second. Thus, a reasonable figure may be established to determine the limit of the impact load for a duration of one second, and the structure may then be engineered to withstand the estimated impact load. While this method may be somewhat an estimated quantity, it does function to serve as an empirical quantity to formulate design.

The leading edge and the wing tips may be damaged to a greater extent during a rough landing than other parts of the wing structure. Therefore, the wing tip and leading edge should be strong enough to withstand the estimated impact loads. It is possible to determine approximately the strength of these parts of the wing structure by means of static tests.

WING SPARS AND RIBS—The wing spars and wing ribs should be analyzed as separate structural components. The distribution of the air load along the wing spars should be determined for the various flight conditions. When an orthodox system of rib spacing is used, the actual air loads on the major members of the wing structure may be analyzed. In the following problems, a two spar wing structure is assumed. The determination of the proportion of the load distribution imposed upon the wing spars during high and low angle of attack is highly important, and is the primary action in an analysis of the wing structure.

To consider wing spars first, the center or pressure (which we can assume to be the line of action of the aerodynamic lift force) is not stationary, but varies with different angles of attack of the wing. When the wing is at a high angle of attack, the center of pressure moves forward and the air load is imposed upon the front spar. Conversely, when the wing is at a low angle of attack, the center of pressure moves to the rear, thus imposing the air load upon the rear spar. The wing spars are thus subjected to two different conditions of air loads and each wing spar should be investigated for both flight conditions.

Consider the model airplane wing illustrated in Fig. 1. The relative positions of the front and rear spar are shown and the shaded area represents the zone of the center of pressure variations along the chord of the wing. Assume that for the high angle of attack condition, the wing is inclined at 16 degrees, while for the low angle of attack condition, it is inclined at 6 degrees. The outer limits of the zone of C.P. variation extend, for the particular airfoil employed, from 0.30 of the chord back from the leading edge for the forward position of the C.P. (high angle of attack), to 0.522 of the chord for the rearward position of the C.P. (low angle of attack).

The airfoil illustrated in Fig. 1 is assumed to be set at the low angle of attack position (6 degrees). Simple mathematical calculations suffice to determine the proportion of the air load which is imposed on single or two spar wings under this condition. These are outlined as follows:

Referring to the figure:

Air Load on Front Spar:

$$\frac{0.925}{3.12} = 0.296 \text{ or } 29.6\% \text{ of the load.}$$

Air Load on Rear Spar:

$$\frac{1.33 + 0.87}{3.12} = \frac{2.20}{3.12} = 0.704 \text{ or } 70.4\% \text{ of the load.}$$

Similar computations are used to determine the air load distribution under

(*Turn to page* 56)

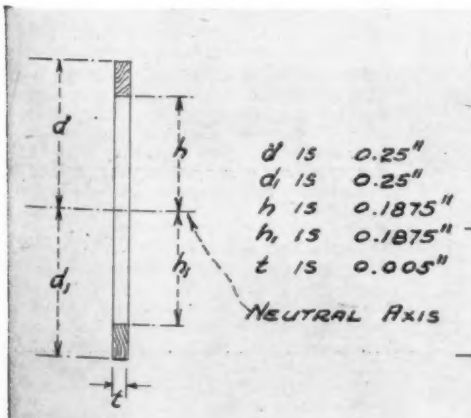


FIG. 5 Cross section and assumed dimensions of typical model rib

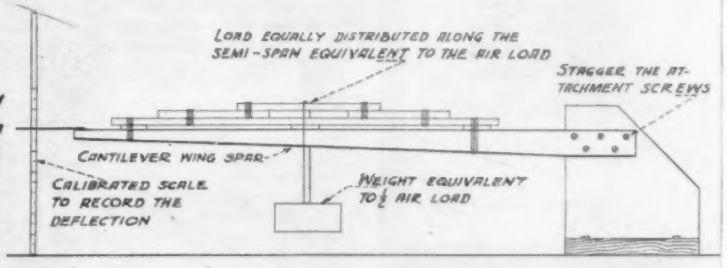
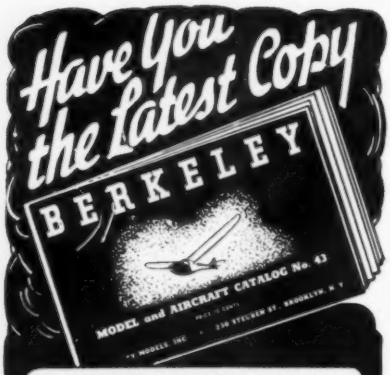

LOAD EQUALLY DISTRIBUTED ALONG THE SEMI-SPAN EQUIVALENT TO THE AIR LOAD
STAGGER THE ATTACHMENT SCREWS
CANTILEVER WING SPAR
CALIBRATED SCALE TO RECORD THE DEFLECTION
WEIGHT EQUIVALENT TO ½ AIR LOAD

FIG. 6 Simple testing rig to show the deflection of a cantilever model wing spar subjected to a normal air load



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Flash News

(Continued from page 2)

ships sailing alone. The Japanese Fleet's main strength is, undoubtedly, in home waters. And as long as it remains there, MacArthur and Nimitz can pare off Japanese holdings in the Pacific as slowly or as quickly as their supplies and equipment permit. Australians are making bets that the War in the Pacific will be won *before* the War in Europe!

AMERICAN FORTRESSES have raided Budapest, Ploesti, Gdynia and Posen to commence operations in general accord with the plans of the Russian Army. The complete lack of a Russian bomber offensive has been questioned repeatedly but it must be borne in mind that the terrain, the tactical problems and the overall strategic plans of Marshal Stalin have not and do not hold a place for a bomber offensive. The start of such an offensive by Allied airmen indicates, for the first time, a combined military plan for the Russian and Allied armies. Nothing disorganizes a retreating army so much as repeated aerial bombardment added to their constant threat of being over-run by the attacking enemy. The German Army in the Balkans is in for some very tough months in the very near future.

PRESENT ESTIMATES would indicate that World War II is going to cost the world just about one trillion dollars, according to Dr. Mabel L. Walker, executive secretary of the Tax Institute. This will be between two and three times the cost of the first World War. By the end of 1944 the nations involved will have spent approximately $900,000,000,000 and 1945 will bring the total past the 13-figure mark. (Wonder how much money that is?)

THE *LUFTWAFFE* fighter strength has been cut about 30%, according to Eighth Air Force sources, and active fighter opposition has been pushed back to the Rhine. Allied fighter pilots on *intruder* operations rarely find Nazi fighters along the invasion coasts and only infrequently do they attack in organized formations.

REVELATION THAT the British *Barracuda* torpedo-bomber has been in action for more than a year came with the story of the Naval attack on the German battleship *Tirpitz* in Alten Fjørd in which *Bararcudas* scored severely damaging hits on the bridge, amidships, the after turret and the forecastle. The *Barracuda* is powered by a Rolls-Royce *Merlin* engine and carries a pilot, an observer and a gunner. Supported by a cover of *Corsair, Hellcat* and *Seafire fighters*, the *Barracudas* used dive-bomber tactics against the marauder, leaving it so severely damaged that Fleet observers believe "it cannot be prepared in time to be a force in the invasion." Obviously we are left with a choice: either the *Tirpitz* was very badly damaged or the invasion is coming very soon, take your choice. Incidentally, this leaves the German Navy with two pocket battleships, the *Admiral Sheer* and the *Luetzow*. The *Gneisenau* lies at Gdynia (recently bombed) with her turrets dismantled. In addition, the German's have only the *Prinz Eugen* and another *Hipper* class cruiser plus two or three light cruisers of the *Koeln* class. For obvious reasons, there will be no Jutland in this war.

CHARLES A. LINDBERGH is in New York and has taken a series of injections against yellow fever and other diseases. These injections are given to all persons going overseas.

REPORTS THAT the Germans are performing operations for the removal of portions of the thyroid of Nazi pilots are current. This operation improves the pilot's resistance to low atmospheric pressures such as are found at high altitudes. The thyroid gland controls the metabolism and thus the consumption of oxygen. When activity of the thyroid is slowed through the removal of a portion of it, metabolism and oxygen intake requirements are lessened proportionately. This report is doubted because pilots so treated would be forced to have frequent doses of thyroid extract for the remainder of their lives.

A NEW NAVAL DISTRICT, designated the 17th, has been established, according to Secretary of the Navy Knox. Embracing Alaska and the Aleutians, which heretofore have had little Naval administrative activities, the 17th will be commanded by Rear Admiral F. E. M. Whiting, a 1912 graduate of the Naval Academy. It follows that a permanent sphere of Naval interest and activity is anticipated in this area.

THE COAST GUARD is now flying the Martin *Mariner* PBM-3 flying boat, largest craft ever used in that branch of the service. Known as the "Flying Cutter," the huge ship carries two .50-caliber machine guns, depth charges and bombs, contains a crew of fourteen officers and enlisted men and is powered by two 1,700 horsepower engines.

ARMY AIR FORCES announces the transfer of all Miami Beach (Florida) training activities to San Antonio, Texas, home of Randolph Field and many others. This is another move towards centralization started with the location of the Training Command Headquarters in Fort Worth, Texas.

WAIST GUNNERS are now blasting the enemy with the aid of a new device known as the Driscoll Gun Sight. The instrument was perfected by Lieut. John Driscoll, gunnery officer of a bomber group, and approximates the accuracy of the Automatic Computing Sight used on power driven turrets although of much simpler construction and very inexpensive. Sub-depots quickly made enough sights to equip all bomber groups in the area, attesting to their simplicity. Although not comparable in accuracy to the turret sights, they are, nevertheless, a decided aid to waist gunners who have used simple fixed bead sights heretofore.

ENGLAND HAS REVEALED the use of rocket anti-aircraft guns for three years, one of the best kept secrets of the war. Similar to German and Russian weapons of the same type, they were under experiment for seven years and received their firing tests in Jamaica in the Spring of 1939. The revelation came when it was announced that the weapon is now in production in this country.

GENERAL MOTORS announces production of a new fighter plane of its own design in one of its divisions, possibly Eastern Aircraft. According to the announcement, the airplane will be entirely of General Motors design and manufacture including the airframe, propeller and engine. Allison is a division of General Motors.

JIMMIE DOOLITTLE has been nominated for promotion to the rank of Lieutenant General by President Roosevelt. Promotions require Congressional ap-

(Turn to page 34)

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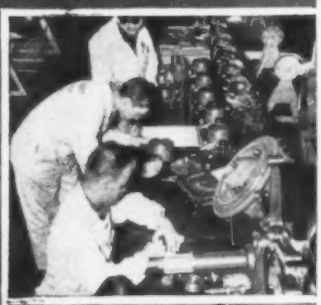

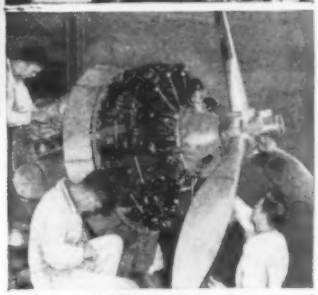

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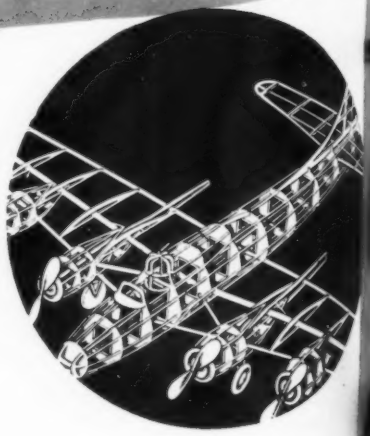

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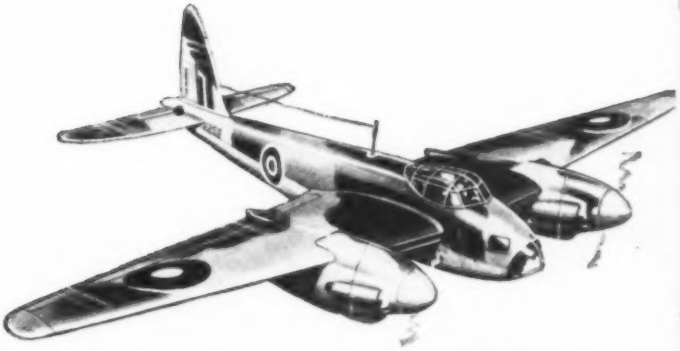

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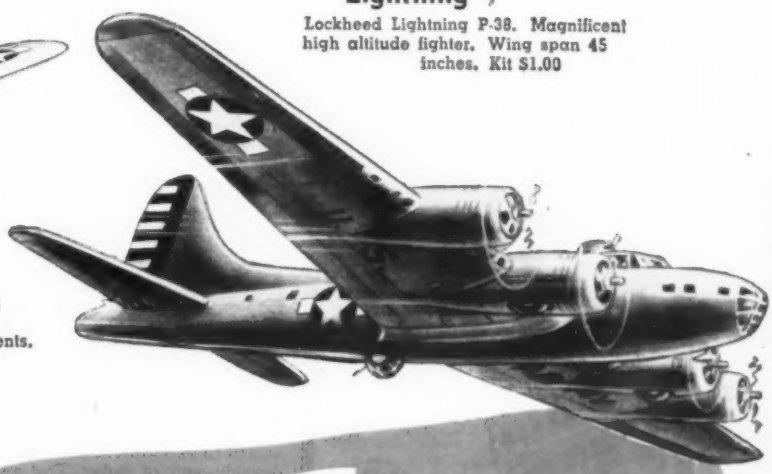

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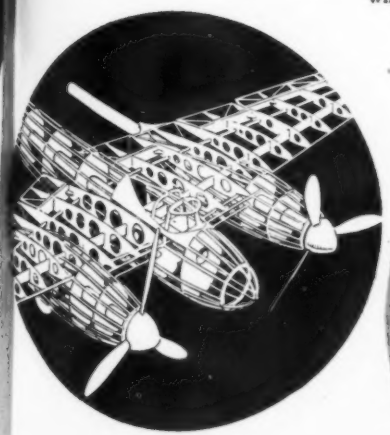

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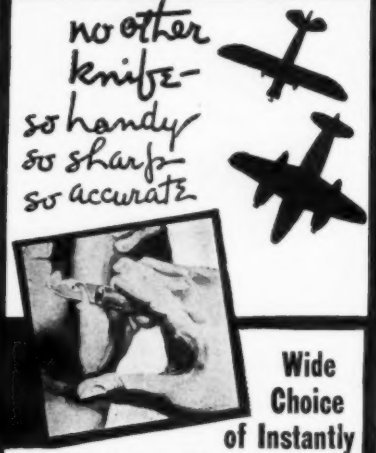

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proval. Doolittle held the rank of Lieut. Colonel when he led the raid on Tokyo on April 18, 1942, for which he was promoted to Brigadier General and awarded the Congressional Medal of Honor. In July, 1942 he was ordered to the Eighth Air Force in England after which he was made commander of the Twelfth Air Force in North Africa. He is now commander of the Eighth Air Force in England.

Other promotions and changes of command have been announced. Brig. Gen. Samuel E. Anderson, who organized and has been directing the low level bombing attacks on the French invasion coasts, has been named commander of the Eighth Air Force Bomber Command. At 38, he is one of the youngest to hold the rank as well as command. Brig. Gen. Elwood R. Quesada, 39 year old veteran of the North African and Italian campaigns has been named commander of the Ninth Air Force Fighter Command, which has been chosen to lead the way in the invasion. Quesada will be remembered, by oldsters, as a crewmember of the Fokker *Question Mark* which set a refueling endurance mark of more than six days over Los Angeles in 1929. Major Gen. Henry J. F. Miller has been appointed commander of the Ninth Air Force Service Command. Miller organized the AAF Service Command shortly after Pearl Harbor with a staff of two officers and two clerks. Today it is the backbone of the Army Air Forces throughout the world.

Major James Stewart, of Hollywood, California, has been named Operations Officer of a *Liberator* bomber group comprising some 48 planes. Jackie "The Kid" Coogan, of the same address, has been commissioned a lieutenant following his feat of landing, first, from a glider in Burma.

THE JAPANESE have made certain changes in command (wonder why?) with Leut. General Takeo Yasuda being relieved of his post as Inspector General of Japanese aviation. General Yuseroku has been named to the post and Lieut. General Kubaysi has been appointed Chief of Staff of national defense in Japan. We wish these "gentlemen" lots of headaches in their new posts.

HONORS HAVE BEEN awarded to John C. Garand and Dr. Albert H. Taylor in the form of the Medal of Merit. Mr. Garand is head engineer of the Army Ordnance Department and received his award in recognition of his development of the infantry rifle bearing his name. Dr. Taylor is Chief Physicist of the Naval Research Laboratory and received his award in recognition of his discovery and development of radar. The awards were made by Secretary of State Cordell Hull, Chairmen of the model award board.

A PRECEDENT AND a jinx have been broken by Major Richard I. Bong, Poplar, Wis., fighter pilot in the South Pacific, who downed his 27th Japanese plane to break the 26-year-old record of Captain Eddie Rickenbacker's World War I score of 26. This record has been equalled but never before exceeded. Major Joe Foss equalled it in the South Pacific but was recalled home before bagging his 27th. He is back in action now, however. Major Greg "Pappy" Boyington, of the Marines, went to his death on a flight seeking his 27th victory. Lieut. Robert Hanson, also a Marine Corps pilot, has been reported missing with 25 enemy planes to his credit.

In the European theater, something of a furor was created recently when Captain Don S. Gentile, fighter pilot with a *Mustang* group in England, was credited with his 30th Nazi victim. However, seven of these were planes destroyed on the ground which are normally not counted in the victory tabulation of a fighter pilot. Gentile is now out of action following a ground-loop at his home base and reports indicate he is to be sent home on leave. Major Walker M. Mahurin was shot down over France last March with a score of 21 to his credit. He was seen to parachute to safety. The ranking ace in Europe continues to be Captain Bob Johnson, Lawton, Ohio ace with 25 victories.

The jinx hasn't deserted the *Ace of Aces*, however, for Major Bong has been assigned to an administrative post in the South Pacific on the heels of his record-breaking performance. Captain Eddie Rickenbacker is dispatching a promised case of Scotch to teetotaler Bong. Other aces include Colonel Neal E. Kearby, reported missing in action in the South Pacific with a score of 21, and Lieut. Col. Thomas Lynch, killed in the same theater after running up a score of 20.

THE RUSSIAN AIR FORCE has not publicized individual fighter aces but we have unearthed the fact that Lieut. Colonel A. Pokryshkin has been awarded the Hero of the Soviet Union, highest Russian decoration, on two occasions for running up a score of 53 German planes!

ON THE PRODUCTION FRONT a world aviation record was set, during the month of March, when a total of 9,118 planes were produced by the United States aviation industry. Of this total, nearly 8,000 were tactical airplanes of fighter, bomber or transport types. Production of heavy bombers was 5% ahead of schedule and this includes the Boeing B-29 *Superfortress*. Philip G. Johnson, President of Boeing, announced that conversion of the Boeing plant from B-17 to B-29 types has been completed and production rates on the giant bombers should zoom accordingly. The B-17 will continue in production, however, at the Douglas and Lockheed plants in Los Angeles, California. Donald Douglas has announced that his firm produced 112,000,000 pounds of planes during the fiscal year and that a total of 160,000 persons are now employed in all divisions of the firm.

THE IGNOBLE state existing at Brewster Aeronautical Corporation is slated to be aired very shortly and the aviation industry is pleased, for the reputation of the firm as designers and manufacturers of Navy fighter and scout-bomber planes does not deserve to be blemished by the recent difficulties. Thomas De Lorenzo, alias Harry Posner and other monickers, head of the Brewster Union and instigator of the abusive conditions at the plant, has been indicted by a federal grand jury for making false statements in a sworn affidavit. This carries a maximum penalty of ten years imprisonment and $10,000 fine. And there are other questions concerning the truth of his statements on draft board records and income tax forms. Henry J. Kaiser is resigning as president of the firm after having restored production and exceeded recent Navy schedules.

However, the Navy Department holds claims in the amount of several million doilars against Brewster in failure to meet production schedule penalties and other charges. Kaiser was installed as President by the Navy as well as by the Board of Directors of the firm. In a statement, he has revealed that the present contract for the production of Vought *Corsair* fighter planes comprises the whole of the firms prospects and with the heavy debt to the Navy the very existence of

the organization is threatened. The outcome of the Navy Department claims will determine the firms' future. Since Kaiser cannot serve the divergent interests of the firm and the Navy simultaneously, he has been forced to resign. Perhaps we express the opinion of the industry when we voice a hope for the survival and future prosperity of Brewster Aeronautical Corp.

PRODUCTION OF 100-octane fuel is nine times in excess of the period during Pearl Harbor and within a few months will be some twelve times as large according to W. W. Vandeveer, a director of the Petroleum Administration.

WILLOW RUN, subject of a violent controversy during its early days, has produced more than 3,000 *Liberator* bombers, and records are being smashed every month, as they have been for the past eight months.

BEECH AIRCRAFT Corporation recently completed arrangements for a $50,000,000 loan, one of the largest private banking transactions in the Middle West. With the curtailment of training plane production, Beech is not acquiring this tremendous capital to increase production on its present types. New facilities might possibly be for the production of a new bomber, perhaps the Boeing B-29 *Superfortress*, insofar as it is being built in the Stearman Division plants, also in Wichita, Kansas.

CLARENCE D. HOWE, Canadian Minister of Munitions, has announced production of the Douglas DC-4 (Army *Skymaster* C-54), "the transport plane most likely to succeed as a postwar type," in the Montreal Government plant operated at Canadian Vickers, Ltd. He also revealed that Canada is "in position" to manufacture jet propulsion units for the postwar world as Canadian engineers have been instrumental in its perfection and several of the planes are now in Canada, undergoing cold weather test, sent there from "the United Kingdom."

A NEW *SUPER FIGHTER*, with "more sensational performance than any now in use," has been announced by the British Air Ministry. "To be ready this Spring" the new craft is fitted with an enormously powerful supercharged engine giving the plane "fine performance at great heights."

GRUMMAN F7F twin-engine Navy fighter was put through its paces recently by "Connie" Converse, chief test pilot, before an enthusiastic audience of eleven veteran Navy fighter pilots from the South Pacific. Among the group was Lieut. George M. Blair, who gained fame by dropping into the waters of Truk during the height of the attack and nonchalantly watching the battle before being picked up in a daring rescue. The F7F exhibition culminated in a long power dive over the field at an altitude of less than a hundred feet. Excited yells went up among them: "You'll have to shoot quick, Jap!" which about sums up the Navy flyers' opinion of the new killer.

THE CONSOLIDATED *Coronado* has been removed from active duty and all are being called in for conversion to transports. The PB2Y-2 has seen extensive service, particularly in the Pacific where it has bombed enemy strongholds repeatedly. As transports, the huge craft will carry 44 passengers or 24 passengers and 8,000 lbs. cargo.

FOREIGN ECONOMIC Administrator Leo T. Crowley has announced that the United States supplied Russia with 8,800 airplanes of which about 4,000 were ferried across the Atlantic, Africa and up to the Red Army. In addition, we have sup-

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To the Industry

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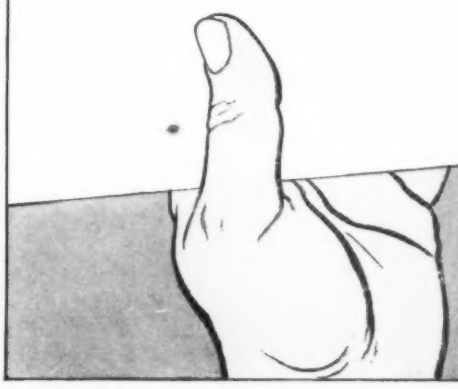
An additional bit of silver lining to our cloud of bad luck will be the brand new facilities for producing an entire new line of timely, up-to-the-minute kits.

Further announcements will appear in these columns, and in the meantime we take this opportunity to thank all of our friends in the trade, for the help and support which has played no small part in assisting us to get under way again so quickly.

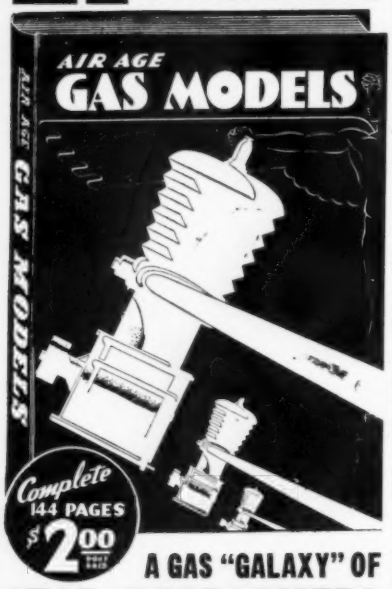
Yours very truly,
CADET AERONAUTICS, INC.

E.B.Miller:mw

E B Miller



21 GAS MODELS



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DOUGLAS AIRCRAFT'S bid for continuance of its unexcelled airline popularity is the DC-7, a mammoth 86-passenger, four-engined monoplane with a range of 4,000 miles. In appearance, a slightly scaled-up *Skymaster*, the giant craft features permanent chair and birth accommodations and the pilot's quarters are covered by streamlined, individual enclosures. Ten tons of cargo are also carried. Pressurized cabin insures high altitude, long-range work exclusively. A bar and lounge are standard equipment. We shall have a great deal more on this plane in the future.

JUAN T. TRIPPE, of Pan American Airways, recently referred to his firm's "post-war clippers" with 12,000 hp, 150 passengers, and 280 mph cruising speed. This may be the new Boeing *Superclipper*, the Lockheed design much larger than the *Constellation*, now under way or the unbelievably huge Consolidated Vultee design capable of carrying 200-250 passengers. It is evident that several foreign nations are hard at work on tomorrow's *superliner* and it is logical that the United States prepare to compete.

However, it is interesting to note that with flying schedules no more frequent than are now being operated between New York and Washington, D.C., these giants could move the entire population of Chicago to Europe in a single year! Post-war airline travel will increase, of course. But some planes now in the drafting stage might slightly depopulate the nation if used on regular schedules!

A REVOLUTIONARY NEW naval scout plane will soon be in production at the Curtiss-Wright Columbus Plant, according to Representative Melvin Maas. "This new scout plane is a vast—and I mean vast—improvement over anything we have," said Maas, after studying plans contained in an aviation subcommittee report. "It is going to revolutionize scouting for battleships and cruisers."

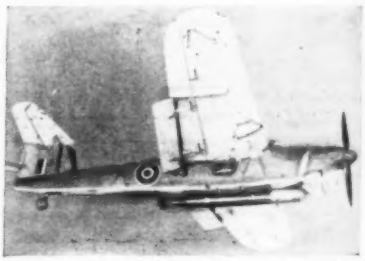
NEWS OF NEW PLANES and the release of additional information on well-known types continues. The *Spitfire* has appeared in a new version with the Rolls-Royce *Griffon II* engine, developing 1,800 hp up to 25,000 feet. The *Griffon*, first announced nearly three years ago, is an enlarged *Merlin* with 2,140 cubic inches displacement. Outstanding feature of the new engine in addition to its higher output is its compactness which has been further enhanced by the use of a remotely-driven accessory gear box. This feature permits the installation of the generator, fuel pump, vacuum pump, hydraulic pump, tachometer and other accessories within the fuselage rather than on the rear of the engine. This space is left clear for the installation of the two-stage supercharger and peculiar water-cooled intercooler continued from the *Merlin XX*. The new *Griffon II* undoubtedly improves the *Spitfire's* already high performance in the 400 mph class, and so the race goes on for the fastest fighter.

SOME DETAILS on Germany's largest airplane, the Blohm & Voss BY-222 are available. The monster has a span of 151 feet and is 123 feet in length. It is powered by six engines and has a two-story fuselage, the lower portion accommodating 100 men equipped with cannon and machine-guns.

THE NEW *MUSTANG* fighter ,officially credited with a top speed of 425 mph, is fitted with a new, streamlined enclosure consisting of a large, formed transparent plastic panel.

WARNING TO WARPLANT OPERATORS: A southern textile mill operator, supplying cloth to the Army, was hard pressed for a solution to his manpower problems. In an attempt to increase production he obtained an "inspirational" motion picture from the War Department in order to spur his workers to greater efforts by showing them the life and times of the men on the fighting fronts. Result: thirty-two men enlisted in the Army and ten women joined the Wacs!

A NEW transcontinental record was established on April 17th when the giant Lockheed *Constellation* 57-passenger transport flew from Los Angeles (Burbank) to Washington, D.C. in 6 hours 58 minutes eclipsing by half an hour the record held by Howard Hughes since January 19th, 1937. The giant craft had been groomed for the flight for nearly a year and its record-smashing performance exceeded all expectations in averaging more than 350 mph on the trip!



Fairey *Barracuda* with torpedo in racks

VICTORY

Fundamentals of Radio Control

(Continued from page 23)

stands in the way of constructing and perfecting the other parts of the equipment.

The control switch on the transmitter may vary from a simple push button to a complete set of controls in a miniature cockpit. A few radio models have several controls consisting of rudder, elevator, motor speed, motor cut-off and even parachute and bomb releases. Naturally more maneuvers can be accomplished with these complicated ships; but experienced radio modelers recommend starting with a simple one, such as with a rudder control alone. It is surprising the number of maneuvers which may be executed with just the rudder control. One radio model has even been made to loop using only a rudder control!

Radio control has not advanced to the stage where it can be used to test-fly a new and untried model. It has been most successful when applied to models already capable of flying well by themselves.

Most important is the fact that radio ships can be put into dives and spirals which would be fatal to the model if a recovery were not made. Therefore it is necessary for the operator to really "fly" his model. Naturally expertness follows practice. Radio controllers admit that radio control is not a "snap," but boy—it's sure lots of fun.

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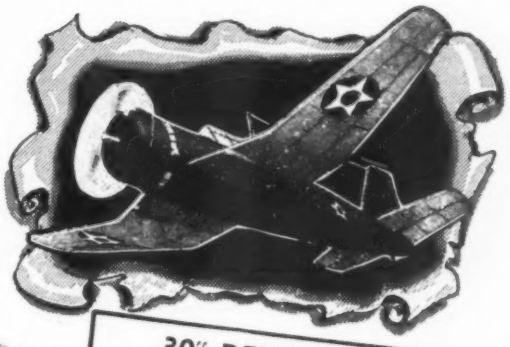

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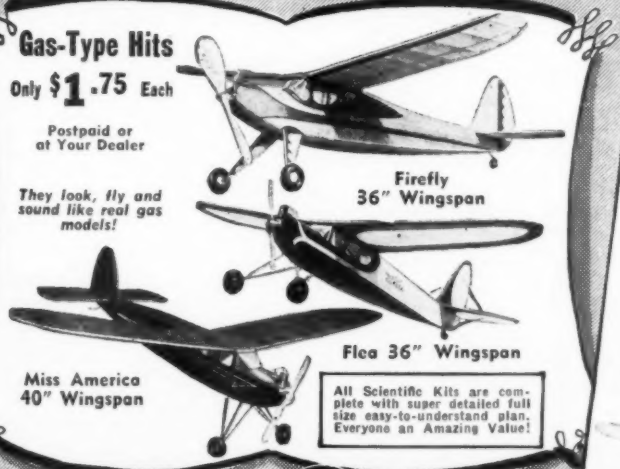

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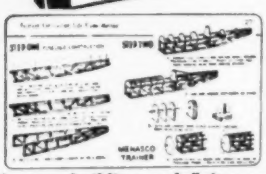

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Air Ways

(Continued from page 25)

building them. I finally had to turn to a professional photographer and even he had quite a job."

Our old friend Allan F. Kitchel, Jr., now a Lieutenant in the Navy, sends in Picture No. 3 of his miniature Consolidated PBY *Catalina* flying boat. Allan, a small scale expert of many years standing, has a collection of 100 such models about 45 of which are replicas of planes in World War I. He says: "The PBY has a span of 4 inches and it may be the smallest *Cat* ever made, I don't know. It took me eight hours to build and ruined an otherwise gay, nautical Saturday night. I didn't keep the model. It's now decorating the desk top of Admiral McFall, Chief of Naval Air Operational Training Command." Having seen many of Allan's jobs, we can personally praise the enclosed.

Picture No. 4 is the work of Cpl. William A. Oates, Jr., Army Air Forces Combat Crew School, Tarrant Field, Fort Worth, Texas, shown in Picture No. 5. He says: "I have been building models for some 14 years and was a member of the Indiana Gas Model Association before joining the Army Air Forces. I am 20 years old and really like my airplane work. I have taken MODEL AIRPLANE NEWS since 1932 and in the February, 1944 issue I found a fine plan for the Consolidated B-24 *Liberator* bomber so I built several of them. You see, this is a *Liberator* field so there is a good market for models of this bomber. I have been getting $15.00 each for the models and the money helps me keep going." Which, of course, isn't a bad idea for those modelers interested in "defraying the expenses" of modeling. Bill works in the Training Aids Department where models of everything for the training of Army Air Forces officers and enlisted men are made. Bill's childhood hobby, obviously, comes in very handy in the Army.

Picture No. 6 represents a truly original experiment and is the type of model work we feel is genuinely valuable to the science. Professor John Hodgdon, shown in Picture No. 7, is responsible for the design and the plane is a cooperative project of the students (both male and female, incidentally) of Tranquillity Union High School, Tranquillity, California. Athletic Coach John Marshall is shown by the model. The fuselage is an N. A. C. A. 0025 modified to a geometric solid and was used to provide the most nearly perfect streamlined form obtainable. The model is a "pusher-puller" in that an Ohlsson 60 is mounted both in the nose and in the tail. A tricycle landing gear is fitted and twin rudders are used. The original version was fitted with an additional motor in each wing but these were removed when the model proved difficult to launch.

Joseph H. Wherry, 658 Okanogan Avenue, Wenatchee, Washington, sends us Picture No. 8 of his French Nieuport 17-C.1, famed World War I fighter, and says that he has been designing and building models for over thirteen years in between eating those famous Wenatchee apples. Recently released from active service as an officer in the Field Artillery, he is taking up where he left off and we hope to present more of Mr. Wherry's work in the very near future.

We can think of no one in a better position to build a detailed scale model of an airplane than the guy who climbs all over it day in and day out in the line of

duty. And Picture No. 9 would sort of prove that contention, and it is possibly the finest detailed scale job ever done on the famed Douglas SBD *Dauntless* dive-bomber. It is the work of Robert W. Johnson of Minneapolis, Minnesota, currently in the Navy at Daytona Beach, Florida, where the *Dauntless* is used as a training ship. Bob sends along a clipping from the *Daytona Dauntless*, station newspaper, containing a story on his model. "Spending some 300 hours, two nights a week, for five months building a model SBD—that's Bob Johnson's idea of spare time well spent," the story says, and any of us could have told them that a long time ago!

In his letter, Bob says: "The model was built in the barracks in my spare time. It is a 31" Cleveland kit, to start with, but the finished job is really detailed. It has retractable landing gear, movable landing and dive flaps, pilot and gunner carved and painted in the cockpit, and the flaps are accurately perforated." It is unfortunate that the photographs do not do real justice to the tremendous skill and pains that went into the model, but perhaps they will give you a rough idea of the remarkable perfection that went into this job. Bob, needless to say, is shown in Picture No. 10.

Picture No. 11 comes from Captain Carlos L. Dodd, an instructor in the Anti-aircraft Artillery School at Camp Davis, North Carolina, and is of his Republic P-47 *Thunderbolt*. He says: "The model has a 30" span and required four months of spare time to build. My duties here have prevented my building a motor and prop which, naturally, would add a great deal to its appearance. The fuselage is planked to the first former aft of the cockpit enclosure and is covered with tissue. It is doped with olive drab, coca brown and sky blue, each with three coats. The nose is red." The photograph is excellent and we should certainly appreciate another one with the engine and prop, when (and if, considering your work) it is completed.

Mr. Norman Deitchman and his original gas job adorn Picture No. 12. A member of the Chicago Balsa Bugs, Norman lives at 1853 South Harding Ave., Chicago 23, Illinois. He writes: "I have been a faithful model builder for ten years. Enclosed is a picture of myself and my original job powered by an Ohlsson '19.' The ship averages about 3-1/2 minutes on a 15-second motor run. The wing span is 44 inches. Our club is temporarily inactive for the duration as most of the members are now in the Air Forces." He promises to send in pictures of his other models as soon as he obtains some film, which we hope is sooner than the "duration."

Picture No. 13 is of Lieutenant Newell P. Witte, member of a night fighter squadron in the Army Air Forces. Lt. Newell says: "I have been away from models for about two years but got that 'bug bite' recently and have started again. Being in the Army handicaps one, as you never know when or where you may move. The picture shows my 'Miss Tiny.' I'm not very proud of its flights; guess I may have 'stayed away too long.' Anyway, I'm on my second gas buggy, my version of the Corben *Super Ace* which used to be my old standby. I am flying Douglas P-70 *Midnight Maulers* and hope to build a model of one of them soon from your plans." We had swell plans of this job in the December, 1943, issue, Newell, so let us have a picture when the job is done.

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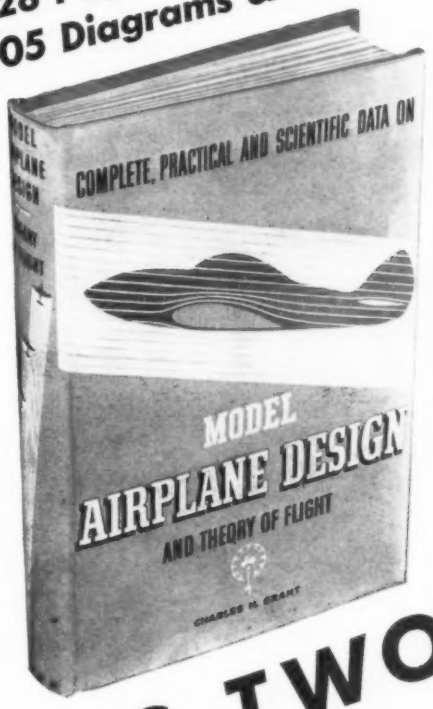

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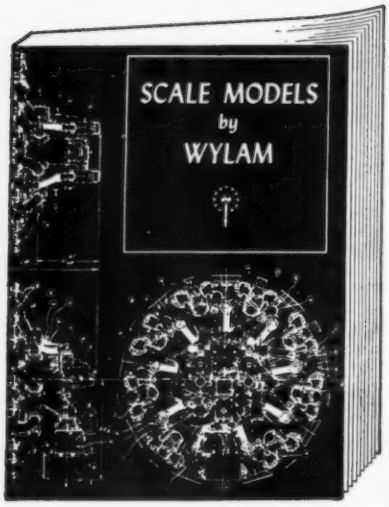

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Picture No. 14 shows the St. Petersburg Model Club, of St. Petersburg, Florida, or at least a few of the members. Bill Hunter, secretary of the club, writes: "In our contests, we use a ratio system that we have been working on for some time. Since the resistance increases as the square of the speed, we figured that it would only be fair to consider this. Our ratio is figured thus: the speed of the airplane is squared and then divided by the displacement of the motor. For instance, our senior advisor for the A.M.A., Don Persons, has a *Tiger* powered *Fireball*. His best speed was 68 miles per hour. This squared is 4,624. This is divided by the displacement of the *Tiger* (.45) and the ratio comes out 102.75. All our ratios were very close and speeds ranged from 38 to 68 miles per hour. This eliminates the need for separate classes. We would like other U-controllers in other parts of the country to try this system and write and tell us their opinions." MODEL AIRPLANE NEWS would like to publish these opinions if it's okay with Bill and the writers. Let us hear from you on this.

Picture No. 15 shows a control-line Stinson *Reliant*, the work of Floyd A. Gambier, Jr., of 1771 North Vermont Ave., Hollywood 27, California. He says: "It has a span of 44" and has a special feature of which I have found no equal. It is a motor control which can be adjusted for idling speeds and there is no trouble with the points. This system has no connection with the points. The plane has flown more than 50 flights and has had some bad landings due to some other ships landing in front of me, but the wheel pants and struts are still as rigid as the day the cement dried." We bet there's a lot of fellas that would be interested in that motor control, so why not send us some details, Floyd?

We've seen loads of trick photographs with double exposures, paste-ups and double printing, but Picture No. 16 takes the cake! It's the work of veteran builder Pfc. LeRoy S. Hubbard, 33530932, S.A.A.C.C., 28th Avn. Squ., San Antonio, Texas, and shows his Bell P-39 *Aircobra*.

He writes: "After reading a few issues of your magazine, model building becomes more interesting to me all the time. I guess I have had about 7 years of the cut and try method, but your magazine makes it evident that precision is easily available. I praise the Cleveland kits and ideas from your magazine. Here is a sample of trick photography with an *Aircobra*. I built this one in my spare time here at the post. I admit that there could be numerous improvements (*I don't know where, do you guys?*) and hereafter I will build better models. I am now working on a Boeing B-17 *Flying Fortress* for the Special Service. It will have a span of about 6-1/2 feet! So far it is turning out swell, a lot better than the *Aircobra*. I have about one month's work on it to do, which will bring it to a total of 2-1/2 months. It has a complete interior even to the fire extinguisher, parachutes and first aid kits. I hope to have a retractable landing gear and numerous other 'headaches'." Boy, don't let "Air Ways" miss that *Fortress*, LeRoy!

CLUB NEWS

California

Maury Fein, 1116 9th Avenue, San Mateo, California, writes: "We have just recently started a new club known as the *Flying Guerrillas*. So far we have 11 members but we are anxious to have many more. We are sponsoring a contest and hope, through this, to attract new members. We would like modelers between the ages of 16 and 21 from San Mateo, Burlingame and Beresford for members. We meet every Thursday night and fly every Sunday morning at Bay Meadows Race Track. The meetings are held at the corner of 9th Avenue and Lawarl Avenue. Anyone interested may contact Mr. Giesh, 814 Grant Street, San Mateo, California.

Ohio

The *Memo*, publication of the Memorial High School in Campbell, Ohio, recently sponsored a model building contest in conjunction with a "Buy-a-Fighter" drive during the Fourth War Loan campaign. A prize of War Stamps was offered for the best model of the North American P-51B *Mustang*. The winner

was Robert Chirakos (see cut) whose model had a span of 32 inches. It is complete with controls movable from the cockpit, planked fuselage, detailed cockpit equipment, and is painted olive-drab and light-blue underside. Bob is a member of the Youngstown (Ohio) Squadron of the Civil Air Patrol Cadets. North American Aviation, Inc., helped the contest by supplying sets of color photographs of their airplanes which were presented to all contestants. The students met their goal of $70,000 in War Bonds and thereby purchased a *Mustang* for the Army Air Forces.

New York

The *Syracuse Model Airplane Club* announces that the 1944 New York State Exchange Outdoor Invitation Meet will be held at Syracuse, New York, on Sunday, June 11. Events will include Gliders, hand-launched and towed; Rubber, stick and cabin; Gas, classes A. B and C. The prizes aggregate $150 in War Stamps, kits and model industry awards. The meet will be sanctioned by the Academy of Model Aeronautics and there will be an entry fee of 25 cents. Entry blanks may be obtained from Harry C. Copeland, Contest Director, 806 Loew Building, Syracuse New York.

The *Prop Spinners Club* announce the results of their Ninth Intro-Club Gas Contest held at Hicksville, Long Island. The winners were Bill Fletcher, First Place; Art Horak, Second Place, and O. Reinhardt, Third Place. The contest was run under the 1943 A.M.A. rules, and Bill Fletcher's 5:37.8 flight was reduced to 2:22.6. This was the only thermal flight of the day.

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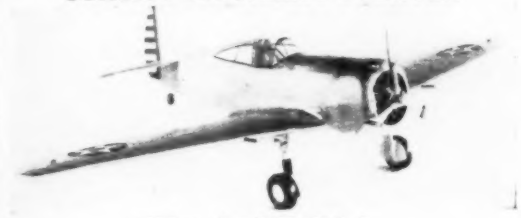

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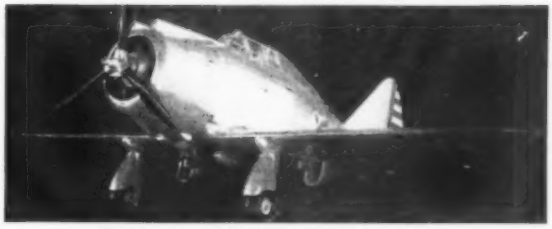

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The "Falcon"

(Continued from page 9)

efficiency of the wing but any slight inefficiency is more than counteracted by the fact that the wing itself won't twist or warp and, unlike the razor-sharp variety the T.E. will not take on a series of undulating waves as soon as the covering is doped.

The center section is made in the same manner as the wing panels. The stabilizer is made up as shown clearly on Plate 2. If it feels a little heavy don't worry, you need the weight to balance the ship and to adhere to the 10-ounce ruling.

The stabilizer, like the wing, is twistproof.

ASSEMBLY—The stabilizer is cemented solidly to the fuselage taking care that the angle of incidence is plus 1° by raising the L.E. 3/32" higher than the T.E.—measured from the top 1/4" square longerons of the fuselage frame.

The center section of the wing is glued to the cabane struts at a plus 3° angle of incidence—this will automatically result if the rear cabane struts are exactly 1/16" below the forward struts—measured from the floor to which their bases are attached.

The method of attaching the wing panels is one that has been used with success, but I admit frankly, that I have discarded it in favour of my own method which is so contrary to accepted practice I hesitated to show it on the plans. My contention is that a wing, if it is fastened with adequate security, either by wing rubbers or dowels, is on so firmly it might just as well be solid—so I make my wing in one piece, secured to the cabane struts with four short 1/16" dia. soft balsa pegs and just one spot of cement on the center of each cabane strut top fairing. In the event a tree or something is hit, the pegs and cement shear off without damage to wing or cabane struts. After a wing has been removed about 75 to 100 times it might be necessary to renew the fairings, but that is a small price to pay for a wing which is immovable by vibration or an accidental tap.

COVERING—The original was covered with *silkspan*, given two coats of clear dope followed by two coats of semi-pigmented black dope for the fuselage and fin and two coats of semi-pigmented yellow dope for wing, pants and horizontal tail surfaces.

ASSEMBLY—The fuselage now being complete, the firewall is next cut out of 1/8" three-ply, and appropriate motor mounts secured in a position which brings the thrust line into its proper location in relation to the side elevation of the aircraft. The thrust setting is zero side and zero up or down. The motor arrangement is shown in the picture of the completed uncovered model. The phantom image of the cowl shows how roomy it is with an Ohlsson "23" installed.

The coil and battery box are mounted on a conventional ignition track fastened or hinged to the firewall, passing through the cutout in the bulkhead and down the inside of the fuselage.

COWL—On the original model the cowl was built up on a form with four layers of bamboo tissue followed by 2 layers of 1/2" wide gauze bandage and then finished with one more layer of bamboo tissue. Each layer was liberally soaked with 50-50 cement and dope mixture. After allowing 24 hours to dry the surface was smoothed down somewhat with garnet paper, doped and filled to a smooth, even contour with what is known as automobile glazing putty—obtainable from any automobile accessory store. The technique of using glazing putty is an easy one. Put about a teaspoonful of putty into a shallow dish, and two drops of glycerine for a plasticizer—if glycerine is unobtainable, use castor oil—then thin down the putty with enough dope solvent to make a creamy paste. Spread the paste with a knife and smooth with the fingers dipped in solvent. Work quickly and neatly. The putty gets quite hard in a matter of minutes. When this surface is dry it can be worked with a file, gar-

(Turn to page 46)

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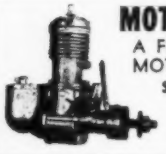

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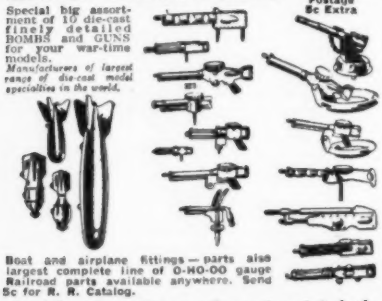

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The Falcon

(*Continued from page* 44)

net paper and finally wet-or-dry paper used with plenty of water. The surface becomes as smooth as glass.

After the cowl has been filled and smoothed, cut through it along the thrust line and remove the top shell. Make cutouts for ailcooling and exhaust stack in the lower part of the shell before removing from the form. The two parts of the finished shell are hinged together with cigar-box hinges applied with cement.

The cowl should be long enough to slip over both firewall and bulkhead. The lower shell is fastened in place with several small spots of cement around its perimeter.

The prop spinner is turned from block-balsa mounted in the chuck of a hand-drill.

FLYING and ADJUSTING—The *Falcon* was carefully designed and the force arrangement thoroughly analyzed but this is only of value if the ship is built with faithful adherence to the outlines of cowl and landing gear fairings. The *Falcon* will fly very well without either, but even better with them.

No adjustments should be necessary, each ship of this series could have been sent up under full power as soon as it left the dining-room table—where it was built. However, to be safe follow the procedure of preliminary testing advocated by competent model builders.

Of course, being obstinate, instead of waiting for an absolutely calm day to do my own testing, I select a day on which a brisk steady breeze is blowing. By supporting the ship between finger and thumb and facing the plane into the wind, flight characteristics can be studied while you are standing still or, at most, walking leisurely forward: a natural wind tunnel which is available to every model builder. Why don't more of us use it?

I hasten to explain that there is a slight difference in construction details between the photograph and the plans which your eagle-eye has no doubt detected. However, before you write any cutting letters to me, or worse, to the editor, let me assure the reader that any changes in construction were merely made to simplify building.

VICTORY

Soviet Stormavik

(*Continued from page 15*)

ment from sticking to them. Pin the keel pieces into position over the plan and cement the keels together at the tail. Cement half the formers in position, one of the tail blocks, and one of the side keels. When the structure is dry, remove it from the plan and add the remaining formers and keel. Align the formers accurately so they are exactly perpendicular to the keels. Next add the stringers, notching the formers as needed. Once a stringer is cemented in place on one side always cement another in the corresponding position on the opposite side.

Cut the metal nose plug from a tin can. Make a paper pattern for the cowl in front of the windshield and the rear cabin. Cut the cowling from 1/32" sheet balsa and cement in place. Pins and rubber bands will keep the sheeting in place until the cement is dry.

The radiator is made from 1/32" sheet balsa. Patterns for the sides and bottom are shown full size on the plan. Cut two sides and the bottom from 1/32" sheet, the parts being cut so the grain runs lengthwise on bottom piece, crosswise on sides. Several pieces will be needed to make the sides. Cement the sides and bottom together at the rear. When dry, bend the bottom up a little and the sides in, and cement together. Repeat this procedure until you have reached the front. Then cut out the top of the radiator which is the same shape as the rear half of the bottom. Cement this in place. Next cut two more sides from 1/32" sheet, this time with the grain running lengthwise and another bottom with the grain running crosswise. Cement these over the original radiator. We now have laminated sides; the centers of the various sides will not sag when doped. Add a piece of 1/8" square balsa at the front of the bottom and glue the sides to it. Round off this edge and cement a piece of screening or large mesh cheese cloth across the opening.

The tail wheel, exhaust stacks, cabin, etc., are added after covering.

EMPENNAGE—The stabilizer is built directly on the plan from 1/16" x 1/8" balsa. The trailing edge is 3/32" x 1/4" pre-cut stock, which has already been cut to a triangular shape. The leading edge is 1/8" square. After the framework is dry, remove it from the plan and cement the 1/16" square balsa cap strips in place. Sand to a streamlined section. The rudder is made in exactly the same way as the stabilizer, and its construction should give you no trouble. Elevator and rudder outlines are found on the plans.

WING—The Clark Y airfoil is used. The use of this section allows the wing to be built directly over the plan. The plan for the right half of the wing is not shown but may be easily made. Place a sheet of carbon paper, shiny side up, on a table. Put your sheet of paper on top of this, then the wing plan. Trace over the plan with a pointed dowel. On the back of your sheet you will have the plan for the right half of the wing.

Make two of each type rib with the exception of No. 1 of which only one is made. All ribs are of 1/16" sheet balsa. The trailing edge is 3/32" x 3/8" triangular-cut pine. The entire wing, with the exception of the spars, is made in one piece. When dry, remove it from the plan and cut the leading and trailing edges half way through, then crack along

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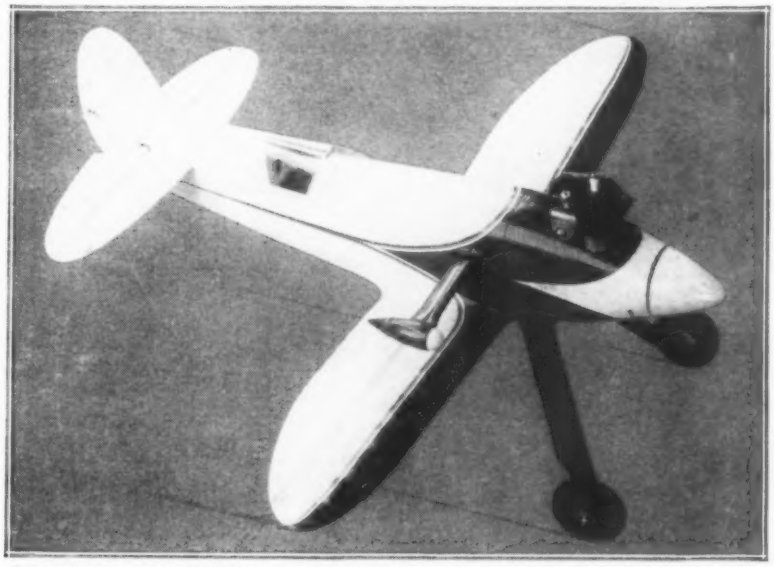

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the center line. Put in the proper dihedral angle and then apply cement liberally to cracked joints. When structure is dry, add the 1/16" sq. balsa spars. Cover the wing center section with 1/32" sheet balsa. Only the upper surface is covered. Add the landing gear using plenty of cement and thread to make sure it will not rip loose. Go over the whole structure with fine sandpaper.

LANDING GEAR—The landing gear is fairly easy to make. The struts to which the wheels are attached are bent from .040" music wire. The other struts are bamboo. Partially bend the wire to the required shape, then add the wheels and washers. Complete the bending operation. Be sure to make a right and left hand strut assembly. The landing gear is now cemented to the leading edge and No. 3 ribs. Sew the wire arm to rib No. 3 using needle and thread. The streamlined fairing into which the wheels retract are added after covering. The wheels on the original model were made of two pieces of 1/8" sheet balsa laminated.

PROPELLER—The performance of any model is dependent on the propeller. We wished our model to look realistic, yet fly well. A three-bladed prop was necessary for realism and, by using the prop shown on the plans, good flights are also common. The propeller shown has ample area and correct pitch and diameter.

The propeller blades are made from medium-hard 3/32" sheet balsa. The full size pattern for the blades is shown on the plan. Sand them to the airfoil shown. Then give each blade a thick coat of thin dope and warp them, all at the same time until the correct camber is obtained. Then, still holding them, allow the blades to almost dry completely, separating them just before the dope cements them together.

The spinner is made from a block of soft balsa. Rough cut it to approximate shape, then cement it to the drivewheel of an electric motor, sewing machine, lathe, etc. and turn it down to its final dimensions using rough, then gradually finer sandpaper. Drill a very small hole through the center of the spinner for the prop shaft. Make a metal bearing for the back of the spinner similar to the nose plug previously described.

Use a ball bearing washer and if possible some sort of free wheeling device. The prop shaft comes through the point of the spinner and is bent into a loop for the winder to be attached to. The spinner is then grooved to receive the prop blades and these are cemented in. Add the rear motor anchor as shown on plans. Give the prop and spinner several coats of clear dope and sand smooth before color doping.

COVERING—Prior to covering the frames, carefully sand them to remove all flaws and roughness. Silkspan is the covering material used, thin dope the adhesive. In covering the fuselage it will be necessary to use several small pieces of tissue in order to work around the curves without wrinkles. The wing is covered with four sections of tissue; one piece for each half of the upper surface of the wing and one piece for each half of the lower surface of the wing. When covering the wing, the tissue should be doped only to the first and last ribs, the leading and trailing edges, and the tips. By not roping the tissue to each rib, it may pull tight over the ribs so the entire surface will be smooth, otherwise, if the covering is doped to all the ribs, it is liable to sag between some ribs while being stretched tight between others. Spray the covered pieces with water and weight down the wing, tail, and rudder on a flat board to prevent them from warping. When dry, give the frames a coat of clear dope and again weight down the flying surfaces.

ASSEMBLY—To assemble the *Stormavik*, first cement the wing into the fuselage recess, then cement the radiator in place underneath the wing. Finish the section from wing to fuselage with small pieces of 1/16" sq. balsa. Add the 1/32" sheet balsa wing fillets. The fillets must fit accurately from wing to fuselage and may need a bit of alteration to fit your model exactly. It will be necessary to cut the side keels to admit the stabilizer. Cement it in place securely. Add the rudder with a slight offset to counteract torque. If the model is to be color doped, the following items are added before spraying: wheel containers, tail wheel, bamboo wheel struts, exhaust stacks, radio antenna and bomb racks. The model is then color doped by spraying as this gives the smooth, glossy finish that is so much desired. A small insecticide sprayer was used for the original model and it worked swell. Try it. Two sprayed coats of color dope are sufficient. If only one coat of clear dope has been used, the weight of the color dope will be negligible and the appearance greatly enhanced.

After the ship is sprayed, add the celluloid cabin. Thin strips of black tissue doped to the celluloid represent the cabin framework. Be careful to avoid cement smears on the celluloid as they make the cabin opaque and cannot be removed. If you want to make your model into the two place version, do not add the sloping rear section of the cabin, but substitute a pair of twin machine guns pointing toward the tail. Control surface outlines are drawn on with black dope by a draftsman's ruling pen, or strips of black tissue may be used. The red star insignia is found on the wings, fuselage sides and rudder of a real ship. Decals look best and should be used if you wish a good-looking model.

FLYING—The original model is powered by six strands (three loops) of 3/16" flat brown rubber. Lubricate the rubber before it is placed in the fuselage.

Before actual flight tests are begun, the model should balance at 1/3 the wing chord. Glide the ship and correct any bad characteristics by warping the stabilizer up or down. Test glides should be made over deep grass. When a good glide is obtained, offset the thrust line with slivers of wood between the nose plug and nose. Increase the number of turns as flights improve. Treat your model with great care until you learn its flight characteristics—and then use a mechanical winder to pack in those turns necessary for long flights, the flights that you'll get with your *Stormavik*.

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Design Forum

(*Continued from page* 19)

immediate approval of the type. Principle problem is the complex airflow from wing to propeller. As the speed increases and the region of serious compressibility (500 mph and up) is reached, the propellers lose their efficiency rapidly due to the natural loss incurred in the propellers themselves plus the increased problems of the airflow around the wing which, at serious compressibility speeds, tends to break away from the skin nearer the leading edge causing increased turbulence in the propeller region. Thus, the pusher design proves disadvantageous as higher speeds are approached. At slower speeds (300 mph and under) they actually claim an advantage over tractor installations insofar as the slipstream is not affecting the fuselage and empennage surfaces in most designs.

In its general layout, Mr. Michael's design is quite pleasing and his installation technique is particularly good. We would not advise the use of "split air-flaps" if, by that, he means combination flaps and dive-brakes for upon opening they would destroy the thrust of the propellers by blanketing the air flow. This would make his airplane uncontrollable near the ground (landing and take-off) and in dive-pullouts.

For obvious reasons Mr. Michael shows a cut-out in the wing trailing edge in the area occupied by the propellers. Outboard the wing chord is extended to accommodate the control surfaces. Wing trailing edges should be straight. This does not mean at right angles to the fuselage but means, simply, that they should be in a straight line. In this instance, let us assume the airplane is flying along with the center-of-pressure at the 28% point. In the case of the rib just inboard of the extension, the 28% point would be at a certain location. However, in the rib just outboard of the break this point would be aft by several inches due to the fact that the chord is greater. This means that at this point a positive torsion moment (actually a combination of bending and shear) would exist tending to twist the outboard section out of the wing. To protect this situation, considerable additional structure would be required, adding weight and complicating the loading in the local area. This applies equally well to leading edges—sudden changes in chord lengths should be avoided.

In the tailless airplane it is vital that the center-of-pressure movement be held to a minimum. In addition, weights are concentrated as much as possible along the center-of-pressure line in the case of the wing and at the center-of-gravity in the case of the fuselage. The location of the tail gunner, with the large weight of the two 20mm cannons is a poor one and introduces serious problems of longitudinal stability. Tail gun implacements are used widely in the conventional airplane (*Liberator, Fortress, Mitchell, Marauder,* etc.) because the horizontal stabilizer, designed for the purpose, insures adequate longitudinal stability (assisted by the elevators).

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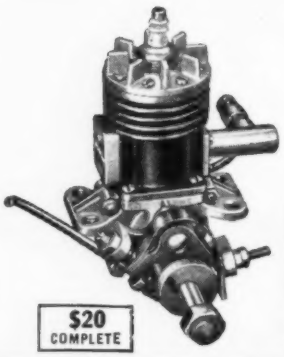

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when the wing itself is properly designed. This feature, then, could be eliminated.

The armament used is excessive, if this is possible in a warplane, in the light of the assigned mission. Mr. Michael has designed an attack-bomber which, by definition, indicates extremely short-range work. The principal advantage of the shell bore gun is its extreme range and it is useful only for long-range combat work. Although his choice of the 40 mm cannon for anti-tank work is a good one, the amazingly successful American .50-caliber machine-gun might better be installed insofar as the secondary armament of a ground-attack machine is principally anti-personnel.

We congratulate Freddy Michael on a good idea, well executed with a minimum of technical weaknesses which, if corrected, should lead to a highly successful airplane.

Design No. 2 comes from Orlin Jacobson and is also an attack plane but differs in the use of two engines and conventional tail surfaces. Fairly conventional in layout, it differs in that rocket-shells are used in addition to 40 mm cannon and .50-caliber machine-guns. The design of military airplanes is not necessarily a contest to see just how many guns can be installed in an airplane. Obviously, the *Thunderbolt* could be equipped with ten 40 mm cannons in the wing and a couple of 75 mm's in the belly, but for what purpose?

As we have frequently pointed out in the past, a successful airplane is a very delicate balance between performance and weight, as one increases the other must decrease to make it possible. For instance, the armament on Mr. Jacobson's plane weighs as follows:

8 .50-caliber machine guns @ 61 lbs.	488 lbs.
2 .40 mm cannon @ 148 lbs.	296 lbs.
8,000 rounds .50-cal. ammunition @ .3 lbs.	2400 lbs.
2,000 rounds 40 mm ammunition @ 1.73 lbs.	3460 lbs.
4 rocket shell chutes @ 36 lbs.	144 lbs.
16 rocket shells @ 12 lbs.	192 lbs.
Total weight of armament (excl. fittings)	6980 lbs.

Thus, Mr. Jacobson's airplane carries almost seven thousand pounds in armament equipment, completely excluding the fittings, brackets and mechanism necessary for the installation of these items. And this is *more* than the gross weight of the famed Hawker *Hurricane* fighter!

Also specified are two Napier *Sabre* engines which, at 2,360 lbs. each, augments the weight by another 4,720 lbs. before adding cooling fluid, fuel and oil and installation weight. Which leads us to the conclusion that merely installing the biggest and most powerful engines available does not promise a deadly warplane.

The only course to follow in successful airplane designing is first, the fixing of a definite, well-detailed purpose and second, the relegation of everything else to this purpose. In this case, Mr. Jacobson started to design an anti-tank ground cooperation machine and wound up with an all-purpose, offensive-defensive, fast-slow, good-bad airplane.

He should have selected the two 40 mm cannons and considered his armament decided, forgetting the rest of the armament, and he should also have selected a single Napier *Sabre* engine as this is enough power for the purpose. With these essentials he could have designed an airplane around them; an airplane small in dimensions, light in weight, high in speed and particularly deadly in its task.

The designer mentally collects all the items required for the specific task assigned the airplane-to-be, making a mental note of their location in respect to each other and then filling in the airplane structure around them. This is the first lesson for the amateur designer to learn: airplanes are designed from the inside out, *not* vice versa!

Design No. 3, the work of Richard E. Lyons, is a typical example of this procedure and the result is a successful design, beautiful in line, practical in layout and, undoubtedly, highly useful for the purpose. The liquid-cooled engine, in this case the famed Rolls-Royce *Merlin*, is installed within the fuselage aft of the pilot with the propeller in the nose, powered by an extension shaft from the engine. We suggest certain changes in the air intake arrangement but these are minor, compared to the compactness of arrangement and particularly efficacious aerodynamic design. The armament is well arranged, particularly the location of the cannon breech at the pilot's feet, providing excellent accessibility while in flight. The large number of .50-caliber guns is excessive, as outlined above, and eight would be entirely as effective.

The use of the 37 mm cannon is not a

good one, however, as this weapon has been one of the disappointments of this war in aircraft ordnance. Actually the fault is not with the weapon itself so much as it is with the tremendous strides made in the development and ultimate perfection of the 20 mm cannon. The following table gives a good comparison of the two weapons:

	20 mm	*37 mm*
Rate of fire, rnds/min	600	150
Muzzle velocity, fps	2920	1250
Effective range, yds	1200	300

There is little doubt of the more powerful charge of the 37 mm shell when it hits but success in aerial battle today depends upon a great quantity of fire with high impact force. In other words the 20 mm shell is traveling faster when it hits, due to the higher muzzle velocity, as this has greater penetration force. It is necessary that a shell be driven into a structure for it to do the most damage. A great advantage of the 20 mm cannon is its light-weight ammunition, meaning that larger quantities may be carried with the same weight allowance as a much smaller quantity 37 mm. It may be appropos to mention that the 37 mm cannons were removed from the Bell *Aircobra* and Lockheed *Lightning* many months ago in favor of the lighter, faster firing, longer ranged 20 mm cannon.

For some time our engineering staff has been re-drawing *Design Forum* airplane designs for presentation but, due to the pressure of other work, we must request that those who desire to submit designs for analysis and discussion in the *Design Forum* department prepare their drawings in India ink, on white drafting paper with conventional triangles and curves. Only drawings suitable for publication in their original submitted form can be used.

VICTORY

This Gadget Air War

(Continued from page 7)

the thickest overcast.

For passive defense against bombardments the enemy has introduced a number of gadgets and devices ranging from fake fires that are ignited when the Allied *Pathfinders* fly over the target, to entire simulated factory areas with chimneys that belch smoke and blast furnaces that glow red on a given signal. Another favorite gadget of the Hun, to lure our intruder planes to disaster, is a simulated night-flying airfield. From the air a series of plane lights appear to be moving down the runway at take-off speed, but actually the device is a series of lights attached to a boom, and drawn by a truck. Around the fake runway are anti-aircraft guns ready to strafe an intruder who dives down on what looks like easy bait. A similar trick worked in daytime is to run dummy planes slowly along a runway. The planes are really coverings for concealed anti-aircraft guns, which uncover and open fire immediately as a pilot dives down to strafe. A similar device is employed by enemy submarines which exhibit a distress flare to lure pilots returning from bombing missions down to drop rescue supplies to the plane which is presumably one of their number who has "ditched." Illuminated by the flare, the bombers are easy targets for the submarine deck guns.

Barrage balloons made their appearance in the last war, and have done yeoman service in this one, especially in thwarting dive bombers and keeping

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medium and heavy bombers at high altitudes. You see them attached to ships and barges and trucks. In the early days of the war the Germans scorned the barrage balloon as a means of defense but suddenly they decided the humble sausage had its uses. The British know a thing or two about balloon cables. Their first answer to the German balloons was to fit armor to the leading edges of their bomber wings. When this did not prove entirely effective they introduced a truly Rube Goldberg gadget which enables a bomber to shoot its way through an interfering cable. The device is a veritable flying blacksmith and simple in operation. The armored leading edge of the bomber's wing is divided into sections by short protruding plugs which prevent the cable from slipping to either side of the section of the wing it strikes. As the cable makes impact against the wing it sets off an explosive charge, which operates a chrome-nickel chisel that secures the cable against the plug which acts as an anvil and nicks it in two. Simple, but effective.

Among the weirdest of gadgets is the degaussing gear for magnet mines fitted to *Wellington* bombers. This consists of a magnetized ring supplied by current from an automobile engine and generator fitted into the bomber. The plane flies low over the water where mines are suspected to have been laid, and presto!—the deadly mines are exploded surely and safely, the plane being beyond reach of the explosion by the time its force reaches the surface.

Sundry U. S. gadgets are playing an important part in winning the air war. One of the most important of these is the new auto-pilot which takes charge of the plane during the target run. The auto-pilot is virtually an electro-mechanical robot which does everything but speak. It will cooperate with the pilot's finger-tip control or take over entirely, automatically correcting errors due to cross-winds, or bumps. If the nose of the airplane drops or rises, or if the wings tilt from the horizontal the robot brings it back, correcting errors with perfect co-ordination.

Another gadget, by which gunners of the USAAF swear, is the self-computing automatic sights produced by Sperry. This device automatically computes the range and speed of enemy aircraft, the gunner's task being to keep the span of the plane in a ground glass sight, the mechanism computing its range and deflection. The high box-scores registered by our big bombers is due, in no small measure, to this wonder device.

Simple devices as well as complicated gyroscopic robots play their part on either side. The British, pressed to desperation by German air and submarine war on Atlantic convoys, hit on the simple idea of catapulting *Hurricane* fighters from decks of freighters, and beating the menace of the German four-engined FW *Kurriers.* The U. S. adapted a radio wave detection device for use on ships, and airplanes, and fitted powerful searchlights to airplanes to assist in searching for underwater raiders, which today seem to have been forced into retirement.

Who would have thought at the beginning of the war, that our flying soldiers would go into action wearing armor like the knights of old? The new anti-flak suit now being issued to the air crews of our heavy bombers is modeled on specimens of medieval armor exhibited in the Metropolitan Museum. It consists of an armored helmet like that worn by the halberdiers in the days of England's Queen Elizabeth, and a cuirass of plates of 20-gauge manganese steel, two inches square, which overlap like the breast feathers of a fowl, and give flexibility as well as protection, with a series of larger plates in appropriate positions. The armor is covered with padded canvas and the suits are so contrived as to be adapted for use by men in various positions of the plane. Numerous lives have been saved by these suits.

How they came into being is just one of those things which happen in war time, when human ingenuity sets out to protect life.

The USAAF found that air gunners and crew members in North Africa were using pieces of armor plate from wrecked machines and wiring them around their positions for ample protection. Some men were carrying small plates over their chests and stomachs inside their flying suits. The USAAF Material Command caught on to the idea, and experiments were immediately conducted in the U. S. to manufacture the ideal suit.

Armoring of machines started in the same way. In the last war we pilots used to put gasoline cans under our seats to dampen the force of enemy bullets, and forthwith armor became a regular feature of combat aircraft.

For training purposes the number of synthetic devices or gadgets grows apace. Bomber gunners are trained by having to shoot at films made of actual attacks made on other bombers by enemy pilots. The trainee has to calculate the speed of the plane and estimate the lead, or trail, necessary to shoot it down. After he has fired an illuminated target appears on the screen and shows him whether he

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has shot down the plane, and where he should have aimed to do so.

Other "synthetics" enable a pilot to complete a 1,000-mile round trip in a twin- or four-engined bomber under conditions simulating the actual flight although he and his crew never leave the hangar. His navigator can plot his course by the stars, while wind directions change frequently. After the war it is probable that many of the synthetic trainer devices will make their appearance in the amusement arcades and will provide real good fun.

The Germans have some gadgets which have made experts on our side scratch their heads as to their utility. One of these is the quick-release bomb rack on the Do 217. Why should a pilot want to release his bomb rack as well as his bombs? The answer may be that in its place the armorers can quickly fit an arrangement of machine guns firing obliquely downward and utilized for ground strafing. This was a Junkers gadget of World War I.

A net little gadget on German dive bombers is a control co-ordinator which takes over for the pilot as he goes down into his dive, absolving him from all responsibility except aiming his machine. Among other things it closes the radiator flaps, sets the tail plane angle, and opens the flaps. When the bomb is released, the device starts to pull the machine out of the dive, and goes through the procedure in reverse.

The Germans have put a great deal of thought and time into the perfection of rocket projectiles and pilotless gliders to wreak destruction on Allied planes and shipping. The rocket gun carried under the wings of FW-190's does not seem to have been outstandingly successful. It consists of a torpedo-like projectile carried in a tube under the wings of the plane and electrically discharged. Allied airmen who have encountered the new weapon state that it is inaccurate, but it apparently carried a large enough explosive charge to destroy a large bomber if a direct hit is scored. German reports, relayed from neutral countries, claim to have achieved this on several occasions.

The German super-secret weapon is the radio-controlled bomber which is said to supersede the rocket gun. According to a Swedish correspondent, the pilotless plane has a speed of about 300-400 miles per hour and a range of four to six miles according to the height from which it is released, said to be between 20,000 and 40,000 feet. The weapon is a high-wing rocket-propelled glider with a torpedo-like projectile carried under the fuselage. It is launched from Dornier 217's which carry it under the fuselage. Aboard the Dornier is a flight director whose task is to sight the glider on its target, and then send it into its final dive at the appropriate moment. Up to the present these bombs do not seem to have met with much success. One report from the Mediterranean of the rocket glider in action indicates that they are not as reliable as the Germans hoped. Although the tiny planes can bank and maneuver like the real thing, sighting proved highly inaccurate. According to an eye witness on board a ship attacked by a rocket glider, the contrivance did a freakish loop over the top of the plane which had launched it, and headed for the convoy. Enroute it did two or three turns, and then dived into the sea half a mile away from the ship at which it was aimed!

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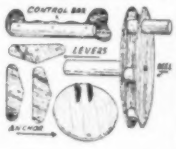

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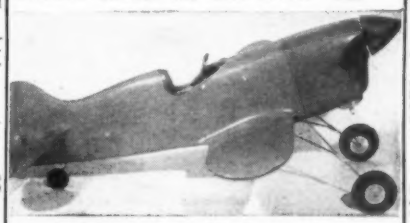

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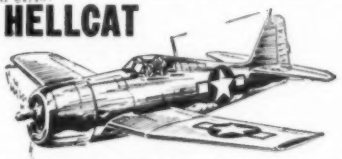

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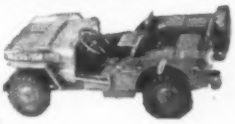

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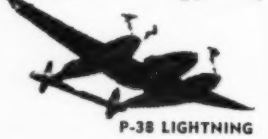
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The U.S. would seem to have made better use of air-borne rockets. A report from Guadalcanal stated that U. S. Marine Corps torpedo planes used rocket-propelled torpedoes against Japanese ships at Rabaul Harbor, hitting at least twelve ships. The rockets are self-propelling projectiles on the bazooka principle and are said to be accurate at long ranges. A device not up to the job of annihilating 300 mph. heavy bombers would seem to have been more than adequate for giving the KO to ships.

One gadget used by the Germans, borders on the fantastic. According to a Swiss correspondent, the Luftwaffe medical-neurological department has discovered that pilots are allergic and responsive to odors of flowers. Lilies of the Valley and Chrysanthemum are definitely demoralizing, but Mint is stimulating and courage-inspiring; so Mint odorizers are installed in the cockpits of German fighter planes, believe it or not.

What a gadget war!

VICTORY

Stress Your Gas Job

(*Continued from page* 29)

the conditions of high angle of attack (16 degrees). In this instance, the proportions become:

Load on Front Spar: 72.1% of total load.
Load on Rear Spar: 27.9% of total load.

The critical load distribution condition for the front spar is that of high angle of attack, whereas the critical load distribution condition for the rear spar is that of low angle of attack.

Frequently, recourse is made to the use of wings of single spar construction in order to attain simplicity and ease of fabrication. In this instance, the entire air load is sustained by the single spar. Single spar construction should usually be employed in conjunction with airfoil sections which have a very small amount of center of pressure movement. Two spar wings are used where airfoil center of pressure variation has a considerable latitude.

To make a complete analysis of a model airplane wing, assume that the high-wing cantilever monoplane illustrated diagrammatically in Fig. 2, incorporates a single spar wing, the dimensions of which are as follows:

Wing Span: 120 in.
Wing Chord: 16 in.

The gross weight of the model is assumed to be 6.25 pounds. Subject one wing panel to the stress analysis because of the symmetry of the wing structure. Each half of the wing supports one-half the weight of the craft or 3.125 pounds. The running load per inch of wing spar then becomes:

$$\frac{3.125}{60} = 0.052 \text{ lb./in.}$$

The wing spar should be investigated for bending. Reference to a mechanic's text or handbook will list the bending moment for a cantilever beam according to the following formula:

$$M = \frac{w \times L^2}{2}$$

where w represents the unit load which is distributed uniformly along the span, and L represents the length of the wing spar in inches. Substituting the quantities derived previously, we have:

$$M = \frac{0.052 \times (60)^2}{2}$$

$$= \frac{0.052 \times 3{,}600}{2}$$

= 187.5 inch pounds

A load factor of 3 will be applied in order to provide against possible gust accelerations likely to be encountered during flight. The bending moment is as follows:

$$M = 187.5 \times 3 = 562.5 \text{ inch pounds}$$

The problem is resolved into the selection of a suitable wing spar to resist this bending moment. Several conventional wing spar cross sections are available. For example, select a wing spar of solid rectangular cross section, a spar of box section, or a routed I-beam section. The rectangular spar possesses the inherent advantage of being relatively easy to fabricate to the desired dimensions. The disposition of the material of the box spar causes it to be highly resistant to torsional loads, this factor being of paramount importance where a single spar wing is used. The conventional I-beam also possesses attractive strength characteristics, the central web tending to absorb the bending loads, while the flanges react against the shear loads caused by the externally applied loads, and, at the same time, offers good rigidity against torsional loads. For example, we will select a spar of the I-beam type.

Reference to Fig. 3 shows the dimensions of the selected spar. The moment of inertia of the selected spar section should be determined first. The formula for this quantity, in this specific example, can be found in a mechanics text, or in any handbook which contains standard tables. The moment of inertia of the conventional I-beam is expressed as follows:

$$I = \frac{b \times d^3 - 2 \times t \times h^3}{12}$$

Substituting:

$$\frac{0.1875 \times 0.125 - 2 \times 0.0625 \times 0.0156}{12} = 0.0018$$

The bending stress in a beam is expressed by the following formula:

$$s = \frac{M \times c}{I}$$

where s represents the bending stress in pounds per square inch, M represents the bending moment in inch pounds, c represents the distance from the neutral axis of the section to the outermost fiber, and I represents the moment of inertia of the section. Substituting the amount derived in the formula:

$$s = \frac{562.5 \times 0.25}{0.0018}$$

= 7,811 pounds per square inch

The selected spar section is assumed to be fabricated of spruce. The ultimate strength of spruce is 9,400 pounds per square inch. The margin of safety then becomes:

$$\text{m.s.} = \frac{9,400}{7,811} = 1.20$$

which is adequate.

It has been a comparatively simple task to conduct the analysis of the single spar wing, because the air load is assumed to be imposed upon the single spar. The center of pressure movement has been ignored, in this example, on the assumption that the aerodynamic characteristics of the selected airfoil section tended to minimize this factor. Suppose, however, we wish to determine the air load distribution on the two spars of the wing shown in Fig. 1, under the two basic flight conditions, namely, high and low angle of attack. We will create an illustrate example by assigning the following:

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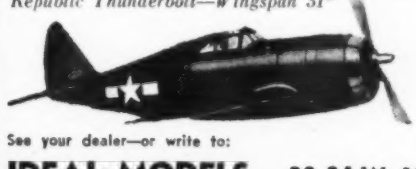

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Wing span	48 inches
Wing chord	6 inches
Weight of model airplane	6-2/3 pounds
Load factor	3

The wing area of the model is then: 48 x 6 = 288 sq. in. The gross loading is: $\frac{6\text{-}2/3 \times 3}{288} = 0.0695$ lbs. per sq. in. The load per inch run along the spar: $\frac{20}{48} = 0.415$ lb. per inch. Referring back to the original computations for the airfoil, shown in Fig. 1, we find that the percentages of the air load sustained by the two wing spars under the two selected flight conditions are as follows:

Low angle of attack condition (6 degrees):

Front Spar	29.6%
Rear Spar	70.4%

High angle of attack condition (16 degrees):

Front Spar	72.1%
Rear Spar	27.9%

We can now calculate the values of air load sustained by each spar under each of the flight conditions of high and low angle of attack. The results are tabulated as follows:

Low angle of attack condition:

Front spar	0.415 x 0.296 = 0.123 lb. per in.
Rear Spar	0.415 x 0.704 = 0.293 lb. per in.

High angle of attack condition:

Front Spar	0.415 x 0.721 = 0.30 lb. per in.
Rear Spar	0.415 x 0.279 = 0.116 lb. per in.

The load data having been determined, the spars may then be analyzed by employing the identical procedure described in the previous problem.

Wing ribs are similar to conventional beams and should be analyzed in a manner similar to that of the wing spars. However, calculation of the air load on a wing rib is more complicated than for wing spars. We know, from our study of elementary aerodynamics, pressure above the upper lifting surface of an airfoil is negative, thus producing an area of reduced pressure in the region adjacent to the surface. At the same time, pressure generated beneath the lower lifting surface is positive. The reduced pressure created above the upper surface of the airfoil becomes responsible for contributing approximately 65 percent, or approximately two-thirds of the lift developed by the airfoil, the remaining one-third being contributed by positive pressure acting against the lower cambered surface of the airfoil. This ratio will tend to vary for different types of airfoils and with angle of attack, but represents a rule-of-thumb that is adequate for preliminary stress analysis calculations.

Each existing type of airfoil has had calculated for it a pressure distribution diagram, pertaining to a specific angle of attack, based on empirical data which has been obtained by wind tunnel experiments. The ordinates or vertical distances on the pressure distribution diagram can be utilized to represent the actual air loads imposed along the length of the wing rib.

Assume that we are in possession of the pressure distribution diagram for the airfoil to be used in the design of a model airplane. The first step, in creating a suitable illustrative problem, is to adopt a specific distance for the wing rib spacing. Assume we have a wing that is subjected to an air load of 0.50 pound per square foot. The chord of the wing is assumed to be 16 inches, and the rib spacing is 3 inches. The load imposed on any individual rib can then be calculated by employing the conventional formula as follows:

P x w x c x s

where P represents the air load on the rib, w represents the wing loading in pounds or ounces per square foot, c represents the length of the wing chord in feet or inches, and s represents the distance apart in feet or inches or spacing of the wing ribs in feet or inches. In this example, this becomes:

$$P = 0.50 \times \frac{16}{12} \times \frac{1}{4}$$

= 0.166 pounds load on the wing rib.

Imposing a load factor of 4, we have:

P = 0.166 x 4 = 0.664 pounds load on the wing rib.

The rib loading diagram illustrated in Fig. 4 is constructed by transferring the ordinates from the pressure distribution diagram of the selected airfoil, to scale, at the angle of attack of normal horizontal flight. On full-scale aircraft, the rib would be analyzed separately, under the conditions of high and low angle of attack, because the loading would vary considerably under each condition. Since the minimum available rib section should prove adequate strength for the most severe condition encountered during the flight of model aircraft, we need not undertake such elaborate analysis.

Refer to Fig. 4. The loads on the rib in question are enumerated as follows:

SECTION	*LOAD (pounds)*
a	1/24
b	3/32
c	1/16
d	13/96
e	5/48
f	7/96
g	1/24
h	1/96

Total = 64/96 = 0.66 pounds

The above loading is seen upon investigation to vary uniformly. It is then possible to analyze the portion of the rib, extending from the center line of the wing spar to the trailing edge, as a cantilever beam which is subjected to a uniformly varying load. The critical condition is that of bending. The bending moment formula may be found in a mechanics handbook as follows:

$$M = \frac{w \times L^2}{6}$$

where w represents the average unit load, and L represents the length of the beam in inches. The average unit in this example becomes:

$$w = \frac{0.66}{16}$$

= 0.041 pound per inch or approximately 1/24 pound per inch. Substituting in the formula:

$$M = \frac{1/24 \times (12)^2}{6} = 1 \text{ inch pound}$$

The bending moment diagram, constructed to the scale of one inch equals one inch pound, is illustrated in Fig. 4.

We can select a metal section to function as a wing rib in this particular example, because it apparently will require only the minimum available thickness of material for the extremely light load. Suppose we make a trial analysis of the

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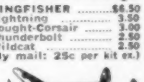

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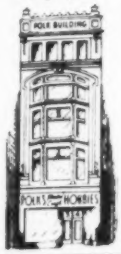

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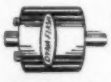

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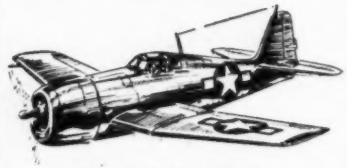

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aluminum alloy section illustrated in Fig. 5. The moment of inertia of the section, the derivation and discussion of which will be found in a mechanics handbook, is developed as follows:

$$I = \frac{t}{2} \times (d^3 + d_1^3 + h^3 + h_1^3)$$

$$= \frac{0.005}{2} \times (0.25^3 + 0.25^3 + 0.1875^3 + 0.1875^3)$$

$$= \frac{0.005}{2} \times (0.0156 + 0.0156 + 0.006 + 0.006)$$

$$= 0.000032$$

Then: Bending stress $= s = \frac{M \times c}{I}$

$$= \frac{1 \times 0.25}{0.000032}$$

$$\doteq 8{,}000 \text{ lb. per sq. in.}$$

The margin of safety is equal to:

$$\text{m.s.} = \frac{16{,}000}{8{,}000} = 2.0$$

which represents an ample allowance.

FLUTTER—Wing, fuselage, or stabilizer flutter may be caused by an undulation in the airflow over the upper surface of the wing, and may also arise because of excessive engine vibration. There are several methods available to eliminate the tendency of wings or stabilizer to flutter. Flutter of the wings causes poor performance. Protracted wing or stabilizer flutter may cause failure of the structure at the joints and bad stability characteristics.

If the tendency of the engine is to vibrate wing or fuselage structure excessively, the weight of the structure should be increased by using slightly heavier structural members. The addition of weight tends to change natural vibratory frequency of the structure to a range which may be beyond the critical resonant point.

If the tendency of the wing or fuselage to flutter is still prevalent, a change in power plants may be made. This should be done in order that maximum horsepower output may be obtained at a crankshaft speed which is not in resonance with the structure. If this latter solution does not solve the problem, the position of the wing may be altered, fore or aft, and the fore and aft stability characteristics changed by altering the angle of incidence of the stabilizer. From experiments, it has been found that when the propeller is located approximately twenty-five percent of the chord forward of the leading edge of the wing, good distribution of the slipstream is possible, and this will tend to dampen wing or stabilizer flutter arising from engine vibration.

STATIC TEST—In Fig. 6 is shown a method of testing the bending characteristics of a wing spar. Note how the load is distributed along the wing spar. The degree of bending is determined by a simple indicating pointer. The deflection of a wing rib under loading is also determined in a similar manner.

It must not be believed that the entire science of airplane stress analysis has been expounded in the foregoing series of articles. Actually, we have merely "scratched the surface" in an endeavor to make available, to interested readers, some means of achieving better performance in their airplane models through the medium of lightening their structural components. At the same time increased strength can be designed into a properly analyzed model to insure its greater ruggedness and longer life.

VICTORY

Avro Lancaster I

(*Continued from page* 13)

dently with his brother, H. V. Roe, the advisability of the latter financing a manufacturing venture. H. V. Roe, who owned the firm of Everitt & Co., manufacturers of webbing, agreed and the A. V. Roe and Company was established in 1910, advertising themselves as "constructors of aeroplanes and accessories." This was the first British aircraft establishment.

In 1911, A. V. Roe & Co. produced the first fully enclosed airplane in the world, a monoplane with an air-cooled Gnome rotary engine. One of the first sales of the type, was a model powered by the 35 horsepower Green engine purchased by Commander Oliver Schwann of the Royal Navy, who later retired as Air Vice Marshal Sir Oliver Schwann. At the time, Schwann was working on the ill-fated airship known as the *Mayfly* in the Vickers shipyard at Barrow-in-Furness under Captain Murray Sueter.

Schwann had the Avro shipped up to Barrow and twin floats were fitted, replacing the wheel gear. Without any flying experience, whatever, Schwann blithely taxied the plane out and took to the air to become the first British pilot to take off from water. The fact that the machine quickly stalled, after leaving the water, and plunged in tail first, does not rob him of this honor. The plane was rather badly damaged but Schwann escaped unhurt. The plane was repaired and in November, 1912, it was flown off the water quite successfully by S. V. Sippe, one of Avro's regular pilots.

In the summer of 1911, the new Avro biplane made its first flight from land, at Brooklands, piloted by Howard Pixton. A version powered by a 40 horsepower E. N. V. engine was sold to Mr. Duigan, who became the first pilot to fly from Australia.

The British Government, officially interested in the military possibilities of the airplane, signed a contract with A. V. Roe for a series of the biplane trainers, powered by the 50 horsepower Gnome engine, and these were the first airplanes designed and built by a British firm to be delivered to the British Army. The Royal Flying Corps was established in April, 1912, and the Central Flying School was opened in August of that year. A competition was held, known as the Military Trials, at Salisbury Plains and it was here that the Avro trainer, powered by the 60 horsepower Green engine, was definitely established with the R.F.C.

Previous training planes had been single-seat designs but Avro produced a two-seater in 1913, powered by an 80 horsepower Gnome engine, which continued with only slight modifications as the standard R.F.C. (later R.A.F.) training plane through 1932 when the Avro *Tutor* was adopted, the latter is used today!

In 1917, H. V. Roe, the brother, left the firm and enlisted in the Royal Flying Corps. He was injured in an accident while night flying in the Vosges and discontinued his interest in aviation. A. V. Roe was joined by the Reverend E. V. Roe as manager of the firm, following H. V.'s resignation. This similarity in names has caused minor confusion for twenty years, but the family name of Verdon was preserved throughout all branches of the family.

A. V. Roe's design ability was not confined to the training types, although it was from these that the firm prospered.

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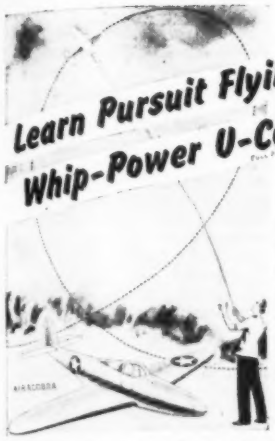

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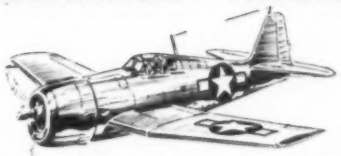

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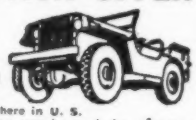

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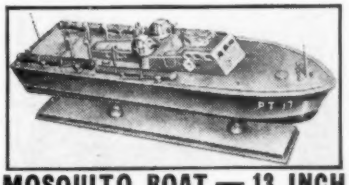

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In 1915, the Avro *Two-Seater Fighter* was developed but was not ordered by the War Office, presumably because of the strong hold the Royal Aircraft Factory (later Royal Aircraft Establishment) maintained on the British aviation design and manufacturing interests. This machine was followed, in short order, by the Avro *Pike* bomber, the *Manchester* bomber, the *Spider* fighter (so-called because of its peculiar wing strut arrangement), the *Baby* sport plane (following the war), the *Bison* fleet spotter and the *Aldershot* bomber in 1923. The ubiquitous Avro 504 K, however, continued as the firm's principal product in peace years.

In 1928, the Sir W. G. Armstrong Whitworth Aircraft, Ltd., a huge holding company, purchased a controlling interest in A. V. Roe & Co. and the founder began to lose interest and freedom in design. The well known Avro *Avian*, designed in 1927, was the last product of the veteran under his own firm.

Early in 1929, A. V. Roe was knighted for his services to British aviation. Shortly afterwards, he severed relations with the firm and the services of Roy Chadwick were secured as chief designer.

Roe had worked closely with S. E. Saunders, a pioneer British aviator and designer of seaplane hulls and flying boats, for many years. Saunders was noted for his major contributions in hydroplane design, and Saunders hulls were used on the Sir Hiram Maxin flying boat of 1909, the Sopwith *Bat Boat* of two years later, and many others. During the war, his firm built Avro trainers under license and Roe had, for many years, entertained a respect and warm friendship with the designer. In the summer of 1929, he joined him in a new venture, known today as Saunders-Roe producers of the Saro *Lerwick*, twin-engine patrol plane and the Model 37, a flying scale version of a projected four-engine flying boat. Sir Alliot Verdon Roe is, at present, publishing a new system of currency devised to straighten out the British monetary system. Although we would say this is a step in the right direction, we neither understand the present system nor Sir Alliot's proposed system, so we reserve decision.

Mr. Chadwick, now Sir Roy Chadwick, continued successfully to produce outstanding Avro designs, notably the *Anson* cooperation machine which saw a great deal of active service the first two years of the war and is still in wide use in Canada as a training machine, although first produced in 1935.

At the outbreak of the war the demand for fighter planes, to stem the *Blitz*, permeated nearly all British design efforts but as the *Battle of Britain* waned into an R.A.F. victory, the shift in emphasis to bombers became apparent. Chadwick designed a twin-engine machine known as the *Manchester*, in 1941, and the plane went into service immediately with the Bomber Command. Although a success, the insistent demand for greater, and even greater, bomb loads forced him to install two additional engines in a new wing of greater span and area and this new version was named the *Lancaster*, our Plane on the Cover this month.

The *Lancaster Mk. I* went into quantity production and, today, carries the brunt of the Bomber Command offensive against Germany. Although aided by *Sterlings* and *Halifaxes*, the *Lancaster* is being used in greater numbers because of its monstrous load-carrying capacity, culminating recently in the regular use of a 12,000 pound bomb, a far greater load than any American bomber now in service could even lift from the ground!

The wing is built in five main sections, a center section carrying the inboard power plant, two outer panels carrying the outboard power plants and two wing tip sections. Each panel is further broken down into detachable leading and trailing edge sections, ailerons, flaps and removable panels. This breakdown permits widely dispersed manufacture, contributing, in no small means, to the vast quantity of *Lancaster* manufacture. The wing is a two-spar structure, each spar consisting of extruded cap strips bolted to a sheet web. The ribs are of the pressed flange type riveted to the spars and stringers. The skin is flush riveted aluminum alloy. Four split, trailing edge flap panels are used.

The fuselage is built in five separate sections, again for ease of manufacture. It is built on two heavy longeron beams with cross beams supporting the upper and lower assemblies comprising the belly and back of the fuselage. Pressed flange frames are riveted to these beams and the stringers and skin are flush riveted. All equipment is installed in the separate sections prior to final assembly.

The tail surfaces consist of a single plane horizontal assembly and two, oval shaped vertical surfaces. The horizontal stabilizer is built in two panels bolted to the fuselage. Construction is all-metal with fabric covered elevators and rudders.

The landing gear is of the retractable type, the main double struts breaking and folding into recesses provided. Retraction is hydraulic with the doors closed by mechanical linkage to the landing gear struts.

The *Lancaster I* is powered by four Rolls-Royce *Merlin XX*, twelve-cylinder liquid cooled engines, of 1,280 horsepower each. Three bladed metal de Havilland constant speed full feathering propellers (Hamilton Standard license) are used. The fuel is carried in six self-sealing fuel tanks and the oil is carried in a small tank within each nacelle for each engine.

There is a crew of seven aboard the *Lancaster:* a bombardier in the lower nose section, a pilot, located above and behind the nose in a large enclosure, a "fighting controller" (or commanding flight officer, ship captain) aft of the pilot within the enclosure, a navigator in the aft end of the enclosure just below the small navigation dome, a radio operator adjacent to the navigator's table, an upper fuselage gunner in a power driven turret and a tail gunner in a power driven turret. Due to the heavy demands made on the British pilot supply, co-pilots are not carried and the pilot has an individual compartment in which he operates alone. It may be assumed, however, that the ship captain is normally capable of handling the plane when necessary. Lavatory facilities and a bed are located amidship attesting to the roominess of the interior. A walkway is provided the entire length of the fuselage and the entrance door is located on the starboard side just forward of the horizontal stabilizer.

Armament aboard the *Lancaster* is extensive and consists of ten Browning .303 caliber machine guns located in four hydraulically operated Nash & Thompson turrets, one in the nose, one on the turtleback, one in the belly and one in the tail, the latter with four machine guns. The tail turret ammunition supply is located amidship and fed by extremely long chutes running the length of the fuselage aft. It has been found that the tail gunner gets the most action by far and demands the most ammunition, thereby. Recent models of the *Halifax* eliminate

the nose gunner altogether, frontal attacks being exceedingly rare.

The bomb compartment is 33 feet long and provides accommodations for a wide variety of fragmentation, demolition and incendiary bombs, ranging up to the 12,000 lb. monster now being employed on short range missions requiring the maximum localized destruction.

Armor protection is amply provided, centering about a solid bulkhead with door for passage, amidship. The pilot's seat is armor plated and various other vitals are protected by plates. Emergency flotation equipment is carried together with full equipment for night operation. Radio, flares, oxygen, de-icing, etc., are installed.

The Avro *Lancaster I* has a wing span of 102 feet and is 69 feet 4 inches long. It stands 20 feet high and has a wing area of 1,297 square feet, weighs 35,000 pounds empty and has a maximum bomb load of 15,800 pounds; This gives it a normal gross weight of 60,000 pounds with a permissible overload weight of 63,000 pounds. It, therefore, has a wing loading of 49.7 lbs./sq. ft. and a power loading of 11.8 lbs./hp.

The *Lancaster I* has a top speed of 275 miles per hour and a range of approximately 3,000 miles.

A later version, the *Lancaster II*, powered by four 1,600 horsepower Bristol *Hercules* 14-cylinder radial air-cooled engines, is now in action but details regarding its weights or performance are restricted. The additional horsepower undoubtedly improves the performance putting the *Lancaster* in the 300 mph bomber class.

With the Royal Air Force Bomber Command carrying the attack to the enemy in 1944 on the wings of the Avro *Lancaster*, Sir Alliot Verdon Roe may look back through the years and see those Albatrosses floating lazily over the stern of his ship and recall that, even then, he sometimes predicted that A. V. Roe, able-bodied seaman, might some day be something more than that. As the greatest British aviation pioneer, he has the verdict of free peoples everywhere that his optimistic prediction was well justified.

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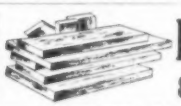

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1/16"x12", 6 for 5c
1/8"x18", 3 for 5c
3/16"x18" ea. 4c
¼"x18" ea. 5c

SPRAY GUNS

Small 79c; De-Luxe Large Size, 2 Jars $1.25

Brass Bushings
1 1/16-⅛ doz. 5c
Gas Model 6 for 5c

GAS MODEL BAMBOO PAPER

Yellow, Blue, White or Red
3 for 25c

SILKSPAN

White only; Gas Model 3 for 25c; Rubber Proof, sheet 5c

AA TISSUE

Asst'd col. dozen 35c
Silver ..... ea. 5c

GAS MODEL ACCESSORIES

Champion Spark Plugs ⅛ or ¼	30c
Solderless Plugs or Tip jacks	15c
Battery Boxes, Sm., Medium	40c
Motor Mts. sm. 15c; Med.	40c
Condensers, best qual. 20c; Metal	35c
Terminal Clips ⅝" 10c val. 2—	5c
Spaghetti Tubing 1 16" 3 ft.—10c	
Toggle Switch 35c. Lightweight	35c
SAE 70 oil—1 pt. 35c. Pint	20c
12" High Tension Leads—Best	15c
Best Quality H.T. leadwire, 3 ft.	10c
20° Booster Leads, special, pair	30c
Solid DURAL Spinner, Small, Lge.	15c
Masking tape—¼"x36"—Instruc	8c
Alligator Clips	10c
Jiffy Switches, stops power dives	35c
Neoprene tubing per foot	20c
Plywood—1/16, ⅛, 3/16, ¼	40c ft.

RUBBER POWER ACCESSORIES

Model Pins 1½"	.50 for 5c
Celluloid 5x7	5c
Ball Bear'g Washer, 5 16 or 7 16	10c
Sandpaper, 2 sheets, 12"x12"	5c

Insignias, four colors, 36 ass'd Amer., French, English, German, gummed, per sheet 5c

Colored, decal-squadron insignias, 6 pr. per sheet, 10 COUNTRIES, ½" dia. ..... 10c; 1½" dia. 15c

Prop Shafts, doz. sm. 6c, lge. 10c
Nose Plugs, 5c, ½" 5c, ¾" 4c, 1" 3c

GENERAL SHERMAN M-4 Tank $2.95

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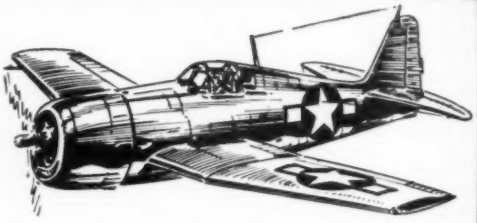
Everyone's Talking About The New C-D

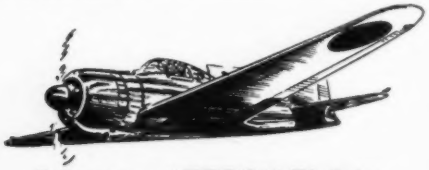
"HELLCAT"



BUILD this beautiful 31¼" model of the plane that's "really going to town". The "Hellcat" is known as "the pilot's dream," because it was actually designed to the features fighting pilots dictated. It has heavy armor, terrific climbing power, and lightning maneuverability—and it practically flies itself, even in taking off; and leads as light and gently as a gull. The "Hellcat" has been used extensively in landings on the Marianas Islands, and other South Pacific theatre of war activities. Be sure to build it. C-D MASTER Flying Model Kit SF-97..... **$3.50**

North American "MUSTANG" (P-51)

Modelbuilders rave over this 27 3/16" miniature of the tough, vicious "Flying Bronco" that has become known as one of the war's most versatile planes. The "Mustang" is a deadly fighter high "upstairs," and equally destructive on ground hugging missions. Pilots like its ease of control at top speeds. C-D MASTER Kit SF-91..... **$3.00**



Japanese "ZERO" Fighter

Cleveland's authentic model version of the speedy, tricky, fast climbing Mitsubishi "00". Even when piloted by the cream of the Jap Air Force, "Zeros" were constantly "exploded" right out of the sky by Allied fighters due to lack of armor and vulnerable fuel tanks. Model span 29¾". C-D MASTER Flying Model Kit SF-86..... **$3.00**

Read What Service Men Say About Model Building

"I consider my several years' experience building models from your detailed ¾" scale plans has helped me considerably in my trade as a radio mechanic in the RCAF, and to overcome the intricate and detailed work involved. Besides this, it has enabled me to start a hobby club in which to give recreational time to other airmen."
A. D. F. LAC, RCAF, Sydney, N. S.

"I have trained as pilot, bombardier and gunner, and many phases of this work, such as aircraft recognition and simple aerodynamics have been made much easier through knowledge gained by building models."
Pfc. W. O'C., Peterson Field Colorado.

"Have had as a background a full model career, and now that I'm in the AAF have turned to Aeronautical Engineering as a post-war outlook, and if I hadn't had the interest stimulated by C-D models, I would hate to think about the future."
Cpl. R. L. W., Paine Field, Wash.

"I have been in the Air Force for the past five years and all this time has been spent working on and instructing in Automatic Flight Control Equipment. I cannot thank you enough for the fine models you have supplied me with. Your models, built by myself, have proven priceless as instruction aids in "Theory of Flight" and "Use of the Automatic Pilot." Again I thank you, for it is you, through your models, who send many a man to combat with a better knowledge of his plane and equipment."
Lt. W. A. H., AAF, Alexandria, La.

CURTISS P-40

A favorite among modelbuilders is this 28⅛" miniature twin of the famous "slugger of the skies". The Curtiss P-40 has fought on every front, and been used as a fighter, fighter-bomber, killer, and for ground cooperation. C-D MASTER Flying Model Kit SF-77..... **$3.00**

★

Bell P-39 "AIRACOBRA"

A swell model of the hard-hitting fighter that the Japs say "is hell on landing boats." The Airacobra "cannon-plane" strikes quick and deadly, and has taken a big toll of enemy tanks, replacements, submarines and big planes. Model span 25½". C-D MASTER Flying Model Kit SF-76..... **$3.00**

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Unusually good model of a secondary type glider. Patterned after "Baby" Bowlus. Easily made. Kit VE-5018.. **50c**

BEGINNERS!

If you've never built any models before, start with the simple C-D gliders, or the C-D Industrial Training Models. The Cleveland SF Models are only for the more experienced. C-D Models are built up from strip stock and printed out curved parts, covered with tissue, and doped with authentic camouflage colors. They are minutely detailed, and authentically designed, capable of beautiful flights with rubber power (when rubber is available).

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[PRINTED IN U.S.A.]

War Planes

Read These Letters from Men in the Services*

"Your precision C-D Kits have proved their value to me repeatedly. Aircraft recognition is a major part of our training, but I became so accustomed to seeing the planes by building models that recognition proved an easy step in obtaining my rate."

K. C. T., AOM 3/c USN, Atlantic City, N. J.

"I'm an infantry man, and to identify friendly and enemy planes in a matter of seconds is very important. I teach airplane identification in my company. Who taught me? Building model airplanes for 5 years helped make me an expert on identifying planes."

PFC H. A., 366th Inf., Camp Atterbury, Ind.

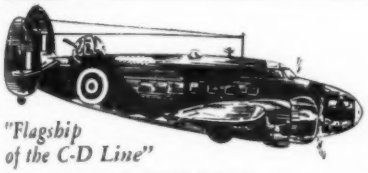
"I am a tail gunner in the RCAF, and instruct students in aerial gunnery. Aircraft recognition is a "must" with a gunner, and building models has been an invaluable help."

H. B. A., RCAF, Fort View, Ont., Canada.

"Building C-D models has given me the ability to consistently score high in aircraft recognition. Being a future Navy aerial gunner, expecting to hold down the rear seat in a dive bomber, my life may some day depend on this ability."

D. E. G., NATTC, Memphis, Tenn.

*Letters are invited from men in all Services, as well as in aviation production, telling how model building has helped them. Those published will entitle writers to free 5" C-D Model Kit. Let's hear from you.



"Flagship of the C-D Line"

Lockheed "HUDSON" Bomber

Build this big 49⅝" authentic model of the bomber that the British fondly call "Old Boomerang" (for she invariably manages to come back). The "Hudson" has been used extensively by the British over Europe and Africa, and by the United Nations over the Pacific. Has bombed, done reconnaissance work, and fought. C-D MASTER Flying Model Kit SF-95 ..... $7.50

Republic P-47 "THUNDERBOLT"

A strikingly realistic model of the "flying battleship", the name most nearly descriptive of the great destructive power of the "Thunderbolt". With a 40,000 ft. ceiling, and 400 m.p.h. plus—the "Thunderbolt" is doing a marvelous umbrella job for the Allied bombing missions over Nazi-occupied territory. Model span 36¾". C-D MASTER Flying Model Kit SF-81 ..... $4.00

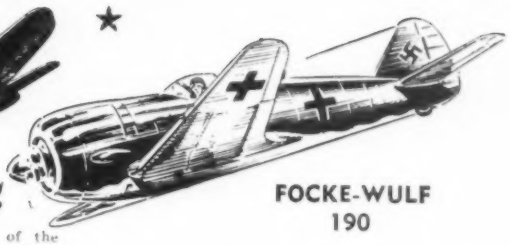
Lockheed P-38 "LIGHTNING"

An instant "best seller" in models because it authentically duplicates one of the war's most extraordinary planes. The "Lightning" can climb so fast as to make the speedy Zero seem almost standing still. It's so fast that pilots have to drop the flaps to keep in a dogfight. High ceiling—terrific diving power. Model span 38¾". C-D MASTER Flying Model Kit SF-85 ..... $4.00

Vought-Sikorsky

"CORSAIR"

Build this miniature "Twin" of the fighter the Marines call the "best d - - - fighter in the world." The Corsair" is considered the world's fastest and deadliest shipboard fighter with a speed greatly in excess of 400 m.p.h. and 6-8 guns. Exceptionally maneuverable. Model span 30 3/16". C-D MASTER Flying Model Kit SF-79 ..... $3.50



FOCKE-WULF 190

Germany's Challenge to Allied Air Superiority

A recently introduced C-D Model in big demand because it's a true miniature of the plane that is offering chief fighter opposition to the Allied bombing missions over Germany. The Focke-Wulf 190 is powerful, in the 390 m.p.h. class, and packs a real wallop in its heavy machine guns and cannon. Latest type is equipped with rocket guns. Model span 27¾". C-D MASTER Flying Model Kit SF-82 ..... $3.00

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T85-P-38 "Lightning"

T91-"Mustang"

T77-"Warhawk"

T78-Hurricane

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T74-Messerschmitt ME-109

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De Havilland "MOSQUITO"

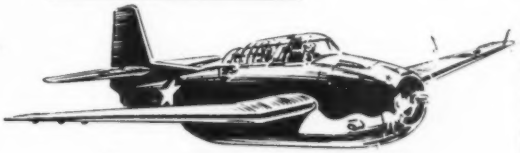
World's Fastest Operational Bomber

Build this sleek, authentic 40¾" miniature of the plane that is considered one of England's outstanding aeronautical achievements in the war. The "Mosquito" has proved itself a first-class pest to the Nazis, for it is classed as a fighter-bomber-intruder, and can sting and then invariably outrun its pursuers. C-D MASTER Flying Model Kit SF-145 ..... $4.50

England's

"WHIRLWIND"

A new and sensational 33¾" model of the high speed interceptor that has made spectacular and toll-taking bombing and strafing raids on Germany's merchant marine. Four 20 mm. cannons carried in the nose of the "Whirlwind" pack a real "Knock-out" in attack power. C-D MASTER Flying Model Kit SF-105 ..... $3.50



Grumman "AVENGER"

A startlingly realistic big 39¾" model of "the plane that saved Midway." In its bold raids on Jap task forces, the carrier-based torpedo bomber "Avenger" has accounted for innumerable ships sunk. First ones were mistaken by the Japs for "Wildcats"—with disastrous results to the Japs. C-D MASTER Flying Model Kit SF-93 ..... $4.00

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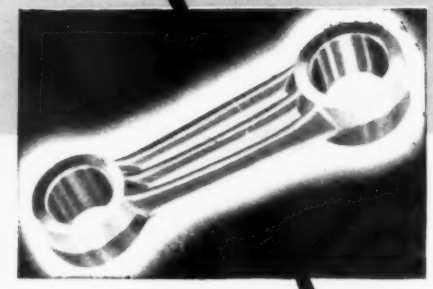

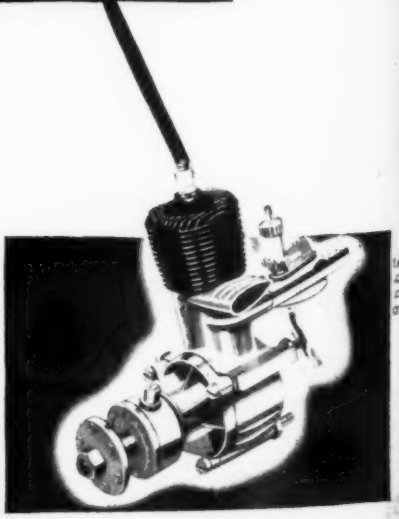

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